Concrete

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Manufacturing and Selling Problems Occupy Products Industry

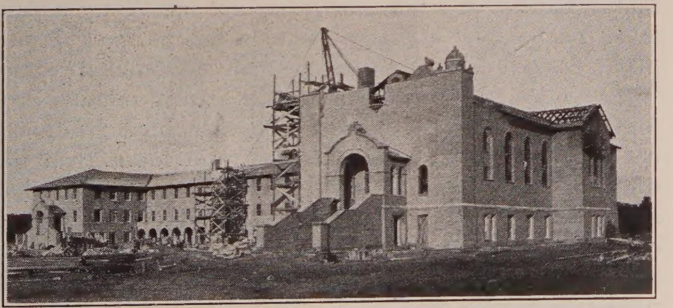
Review Shows Continued Success of Light-Weight Units and Cast Stone—Much Laboratory Research in Progress—Definite Advantages in High-Pressure Steam Curing—A. S. T. M. and Federal Specifications Promised

CONTINUED use of concrete masonry and back-up units in large buildings, sustained interest in light-weight aggregates, development of the use of colors, and growing attention to manufacturing and selling problems are some of the outstanding developments in the concrete products industry of 1930.

Laboratory Research and Field Investigations

Much has been accomplished, both in 1930 and in the previous year, by the Portland Cement Association in conducting laboratory investigations that are solving several of the most troublesome problems of the industry.

Causes of Shrinkage. As one result of the investigations just mentioned it may now be said that the causes of the formation of shrinkage cracks in concrete masonry walls are definitely determined. Such cracking, it is now known, can be avoided if the units are completely cured and air-dry before being placed in the wall. Complete curing, in the sense here employed, means that the units cured by ordinary methods should be not less than 28 days old when placed in the wall.



Pottsco light-weight back-up units were used in this monastery at Burlington, Wis.

High-Pressure Steam Curing. Another of the laboratory investigations to which reference has been made, and which has now been completed, was conducted mainly at the plant of the Crume Brick Company, at Dayton, Ohio, in co-operation with the association, to determine the effects of high-pressure steam curing of concrete masonry units. The results of those tests are given in condensed form in this issue of CONCRETE, in an abstract taken from the *Journal* of the American Concrete Institute. It should be said here, however, that in two days this method of curing develops the full strength of the units and eliminates practically all tendency toward shrinkage.

Gleneagle Apartment Building, in Montreal. Light-weight haydite concrete units used as back-up in exterior walls

Research Associate at Bureau of Standards. An ambitious program of research affecting cinder concrete building units has been inaugurated by the National Building Units Corporation, this organization having placed a research associate in the United States Bureau of Standards. This program of investigation is expected to cover a number of years, and should do much toward establishing confidence in this material.

A. S. T. M. and Federal Specifications

Both the American Society for Testing Materials and the Federal Specifications Board are expected soon to announce standard specifications for hollow concrete masonry units. It is expected, also, that in their main features both specifications will be in substantial agreement with the present specification sponsored by the American Concrete Institute.

Work on the proposed A. S. T. M. specification was started early in 1930, when Committee C-10 on Hollow Masonry Building Units increased its membership and enlarged the scope of its work with this purpose in view.

The master specification soon to be promulgated by the Federal Specifications Board will become the purchase specification for the various construction departments of the United States government.

Professional Building, Kansas City. Haydite brick and tile units and haydite concrete floors made a light superstructure

Light-Weight Aggregates

The situation with respect to light-weight aggregates is much as it was a year ago. Cinders continue to be used in great quantity, the larger manufacturing group using run-of-boiler cinders and depending on the selection of the proper source of supply to provide a satisfactory material. Other groups use cinders that have been washed or otherwise treated.

Some progress has been made in New York with the development of a light-weight aggregate by sintering ashes and cinders from low-pressure boilers and other sources from which cinders, in the raw state, are not suitable as aggregates.

Among the manufactured light-weight aggregates, haydite continues to be widely used by products manufacturers, and the past year has seen some notable cases of the use of haydite concrete back-up and partition units in important buildings of large size. Another and more recent burned clay aggregate, produced on the Pacific Coast, is known as "Argil-lite."

An encouraging increase in the use of "pottsco" has also been reported. This light-weight aggregate is a water-cooled slag. Ordinary blast-furnace slag, a by-product of the steel industry, continues to be used in the sections where it is produced.

Natural sources of light-weight aggregates, such as volcanic rock and scoria (the latter in the northwest, on both sides of the Canadian boundary) continue to supply local needs.

Light-Weight Units

It can be said that the bulk of the progress being made toward placing hollow concrete back-up and partition units into large buildings is being made with units manufactured from light-weight aggregates; but this is by no means true in all sections of the country. Much credit is due another manufacturing group, producers of "Stonetile," for their success in winning acceptance of these comparatively small units for use in the larger commercial and investment buildings, although for the most part these units are made with ordinary aggregates.

In units of the more usual size, many individual manufacturers have succeeded in making a light-weight product out of ordinary stone or gravel and sand aggregates by paying especial attention to the design of the unit itself. Units of this type are described and illustrated in the November, 1930, issue of CONCRETE, pages 20 to 22.

Manufacturing Methods Improving

Manufacturing methods are being improved through the installation of better equipment, improvements in plant arrangement, betterment of curing methods, and the use of vibrating equipment.

Vibrating Methods. Both electrically-driven and compressed air-driven vibrating equipment is employed, especially in the special lines such as the manufacture of cast stone and concrete pressure pipe and drain tile. With frequencies of around 3,600 vibrations per minute, the concrete is subjected to a quaking action that compacts it into a dense mass having great strength and low absorption. Mixtures of a dry consistency not sufficiently plastic to be puddled by ordinary methods can be quaked into place by such vibrating equipment in a thoroughly satisfactory manner. This means that a greater relative proportion of aggregates may be used than under ordinary conditions, or that a water-cement ratio lower than the ordinary ratios may be employed. The result is that strengths now being attained by vibration are far in excess of those formerly obtained.

Diversification of Products. The diversification of products has also received more than usual attention during 1930, for many manufacturers have found this policy useful, when not carried to extremes, as a means of completely covering their markets.

Piece-Work Pay System. The piece-work pay system, as employed in a Wisconsin plant, is described in detail in the June, 1930, issue of CONCRETE, pages 16 to 18. In the plant described the system has resulted in a greater output, lower unit labor costs but increased daily earnings for workmen, and the quality of the product has been maintained.

Merchandising Methods

The interest in better merchandising methods may well be judged from the prominence given to this subject in the forthcoming joint annual meeting of the Concrete Masonry Association and the Wisconsin Concrete Products Association. After all is said and done, the manufactured product must be sold, and this fact is recognized as constituting one of the major problems of the industry. It is one of the prominent subjects in the future plans of the Concrete Masonry Association.

Applying Industrial Methods to the Industry

One of the outstanding contributions to the problem of applying industrial methods to the manufacture of concrete products is seen in a series of articles by Fred A. Sager, the first of which appeared in the December, 1930, issue of CONCRETE, page 33. This series, running monthly, will accomplish much toward pointing out the right direction for the industry's development.

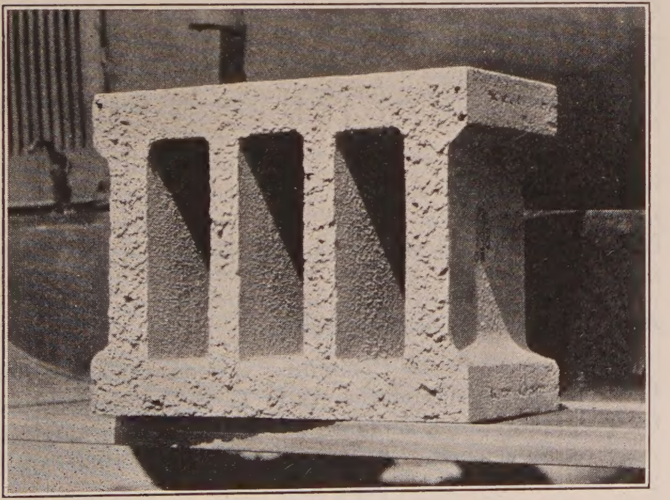
Cast Stone

Cast stone continues to hold a prominent place, and the Cast Stone Institute has wisely continued its research and advertising programs in the face of lower building construction volumes. Further research will be undertaken, the exact program depending on the results of a referendum now before the membership.

Detail sheets for the use of architects, prepared monthly, are now available and will doubtless serve well as missionaries of good will. Specifications, likewise, have been prepared for the use of architects (See CONCRETE, September, 1930, pages 33 and 34).

Use of Color

The use of color, both in cast stone and in more ordinary products, is receiving more and more attention from products manufacturers. Contributions to this subject having special application to the products industry include the report of Committee 703 of the American Concrete Institute, abstracted in CONCRETE, June 1930, pages 43 and 44, and an article on testing cement colors, in the April, 1930, issue, page 36.



This light-weight 12-inch unit of ordinary sand and gravel concrete has thin shells and webs of strong concrete

National Silo Code of Ethics

Development in another special direction is seen in the action of the National Silo Research Council in adopting a code of ethics embodied in a set of fair trade practice rules.

The code, printed in the April, 1930, issue of CONCRETE, pages 41 and 42, was signed by some fifty companies, and resulted in the clearing away of many bad practices which many years of unbridled competition had developed.

Y. M. C. A., at Reading, Pa., required 70,000 back-up and partition units of cinder concrete

Burial Vault Specifications Soon Ready

Another special line, the manufacture of concrete burial vaults, is emerging from a former unsatisfactory condition and developing more orderly progress. Early in 1930 the National Concrete Burial Vault Association was organized. Since then a committee representing that organization has co-operated with the American Concrete Institute and the Portland Cement Association in the preparation of standard specifications and manufacturing methods, expected to be ready for distribution early in 1931.

Specialties

Among the special methods and products developed in the industry during 1930, several are of exceptional interest. One is a new construction method in which concrete masonry units, laid up as dry masonry, are "welded" by a cement gun, which shoots mortar into the joints and then coats the entire surface. The method is described and illustrated in CONCRETE, September, 1930, pages 27 to 29.

Another promising specialty is a metal-faced lightweight concrete slab or block, used for exterior or interior trim, spandrels, frieze courses and other architectural details, or for the entire surface of buildings. Any commercial metal may be used as the facing material.

Some progress has been made toward the perfection of processes whereby an extremely glossy finish can be obtained on cast stone, without the necessity for mechanical polishing. Complete success in this direction would open up a market of great value.

Structural Design and Construction of Concrete Improved in 1930

Cement Specifications Raised—Revising Joint Committee Report—Using More Ready-Mixed Concrete and Bulk Cement—New Practice in Floor Construction—Some Great Concrete Dams

MANY events occurred during 1930 which have a direct bearing, in greater or lesser degree, on the design and construction of structures of plain and reinforced concrete. It can be said that the year has seen real advancement in many directions.

Concrete Needs Density as Well as Strength

The past year has seen a distinct spread of the conviction that high-quality concrete means density as well as strength. The latter quality is needed, and it is being attained in a higher degree than ever before; but density is also needed, in all exposed locations, to prevent the inroads of weathering and thereby to insure durability.

Trustees System Building, Chicago, one of tallest reinforced concrete buildings. Columns have cast-iron cores. Tower portion has concrete-encased structural steel frame

Cement Specifications Tightened Up

The American Society for Testing Materials, in the course of 1930, adopted a material increase in the specification requirements for standard portland cement, including an increase in the 7-day tensile strength of mortar briquettes from 225 to 275 lb. per sq. in., while the 28-day requirement is moved up from 325 to 350 lb. per sq. in.

Specifications for High-Early-Strength Cement

Following the necessary preliminary steps taken in 1929, the A. S. T. M. during 1930 completed and adopted its Tentative Specifications and Tests for High-Early-Strength Portland Cement (Serial designation C 74-30 T). The 1:3 mortar tensile strength requirement is placed at 275 lb. per sq. in. in 24 hours, and 375 lb. in 72 hours, and the 28-day strength must be at least equal to the strength at 72 hours.

Concrete Aggregates

Concrete aggregates have been much in the limelight. Further interest has been manifested in the use of large size aggregates in massive work, particularly in structures such as dams. Mixers capable of handling aggregates up to 9-inch sizes were installed at the mixing plants. The concrete containing these large aggregate sizes was tamped or puddled by means of electric-driven tampers or vibrators. Power tamping, in fact, was the only method by which concrete of this character could be manipulated.

An extensive report on the concrete-making properties of blast-furnace slag was issued during the year by a section of Committee C-9 on Concrete and Concrete Aggregates, of the A. S. T. M. (See abstract in CONCRETE, January, 1931, page 34). This study disclosed that the concrete-making qualities of slag aggregate improve with increased weight.

The results of tests at the University of Illinois, made for the purpose of studying the structural properties of haydite concrete, are printed in a detailed report in the October (1930) *Journal* of the American Concrete Institute.

Admixtures and Waterproofing

A subcommittee of Committee C-9 on Concrete and Concrete Aggregates of the A. S. T. M. has undertaken the preparation of a standard specification governing admixtures in concrete (See CONCRETE, June, 1930, page 24, and January, 1931, page 26).

In the realm of waterproofing the most important current development is the investigation of waterproofing compounds under way at the United States Bureau of Standards. The investigation includes about 75 commercial products, both integral and surface-applied, that are sold as waterproofers.

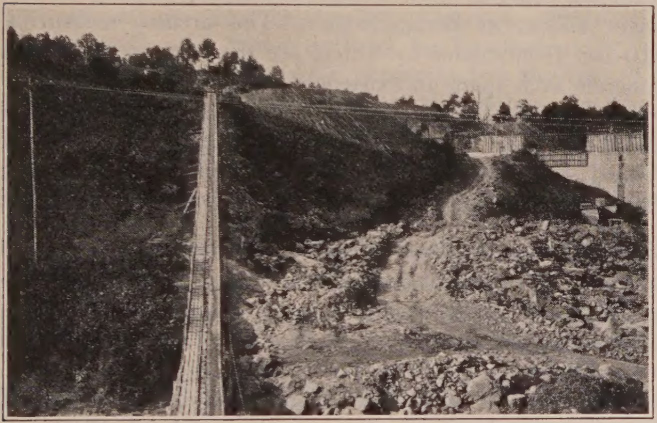
Design of Reinforced Concrete Structures

Designers of reinforced concrete structures will be affected by a number of activities that were either completed or under way in 1930.

One item of particular interest is the prospective revision of the 1924 Report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete. This committee has been re-formed and is actively engaged in the work of studying and revising the old report. (See CONCRETE, June, 1930, page 26, and Sept., page 34.)

The American Railway Engineering Association has performed an important service to designers with the development of formulas for the design of flat-slab structures under concentrated railway and highway loading. Specifications and formulas covering this subject were adopted at the annual meeting of the A. R. E. A. and printed in that organization's "Report of Committee on Masonry."

During the entire year of 1930, CONCRETE published additional simplified design charts by James R. Griffith. These charts, now totaling 38 in number, have been assembled and printed as a single set.



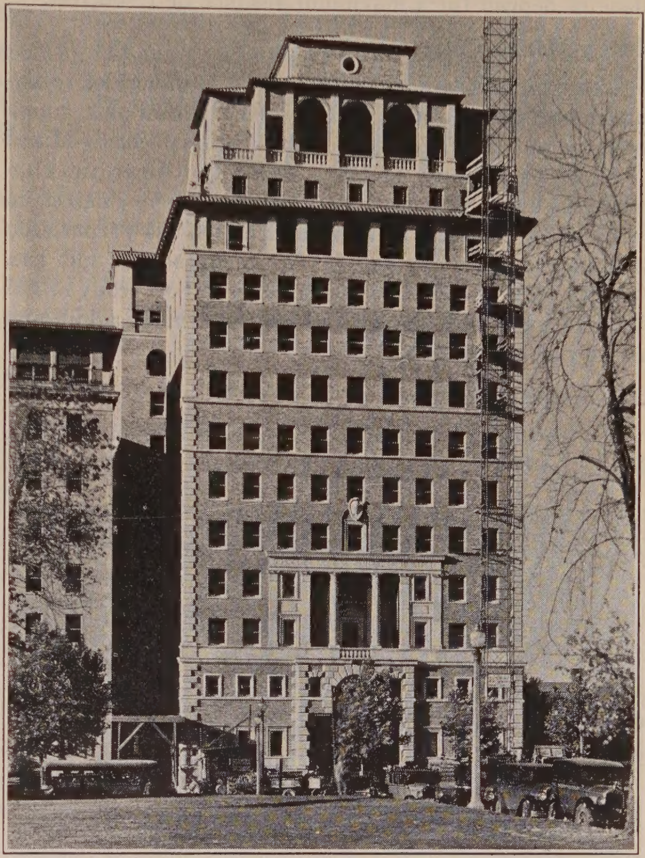
This belt conveyor carried concrete from mixing plant to place of deposit, for maximum distance of 1,900 ft. Wilmington dam, in Delaware

A committee of the American Concrete Institute is continuing its study of reinforced concrete columns by means of load tests being conducted in part at Lehigh University and in part at the University of Illinois.

Designers of the structural frames and other structural parts of buildings—tall buildings more especially—are manifesting more and more interest in strong and rigid frames and light weight. Frames of reinforced concrete, to insure strength and rigidity, are being built to greater heights than ever before, column sizes being held down through the use of cores of structural steel H-beams or cast iron centers. Lightness in the structural frame itself, and in the floor construction, is being obtained through the use of light-weight aggregates in the concrete.

Combination of Steel and Concrete

In addition to the use of structural steel and cast iron as cores in reinforced concrete columns, the past year has seen much progress toward recognition of the economic value of combinations of structural steel and concrete in floor construction. The greatest single advancement in this direction was the report of the load tests on concrete-encased steel beams and girders sponsored by the Western Society of Engineers. An abstract of the report of the committee representing that society is printed in the June, 1930, issue of CONCRETE, page 34. Formulas for the design of concrete-encased steel beams and girders, probably the most comprehensive formulas published to the present date, are printed in the same issue of CONCRETE, pages 35 to 37.



Light and strong superstructure with columns and floor construction of haydite concrete. Oscar Johnson Institute and McMillan Hospital, St. Louis

Architectural Concrete

Continued interest has been shown in the possibilities of concrete in architecture, more especially in conjunction with the use of color.

Contributions of outstanding value with respect to cement colors and their use in concrete work include an article on testing cement colors, in the April, 1930, issue of CONCRETE, page 36; the report of Committee 703 of the American Concrete Institute, abstracted in the June, 1930, issue of CONCRETE, pages 43 and 44; and two articles on producing colored concrete work, in the September, 1930, issue, pages 45 to 47, and in the issue following, pages 43 to 45.

Transporting and Placing Concrete

Among the methods of transporting concrete from the mixer to the point of deposit, special mention should be made of the portable belt conveyor method first used on the Merchandise Mart, in Chicago, and described in the October, 1929, issue of CONCRETE, pages 13 to 16. Another notable construction project in which the same method was employed is described in the September, 1930, issue, pages 13 to 15.

The practical value of a continuous belt conveyor on a large project was well demonstrated in the recent construction of a dam near Wilmington, Delaware, where th concrete was thus transported from the mixer to the place of deposit for a maximum distance of 1,900 feet.

Ready-Mixed Concrete

Great strides were made during 1930 in the use of ready-mixed concrete. A notable step taken within this young industry was the formation of the National Ready-Mixed Concrete Association, in May, 1930. The American Concrete Institute, likewise, has shown a keen interest in ready-mixed concrete and has undertaken the preparation of standard specifications for its manufacture and use.

Many new plants for the production of ready-mixed concrete were built during the year and many additional ones are contemplated.

Use of Bulk Cement

The use of bulk cement on large construction projects, and in concrete products and ready-mixed concrete plants, has become increasingly common. There has been a corresponding advance in the development of equipment for shipping, handling and storing bulk cement. Several large-capacity bulk cement carrying vessels were launched during the year for operation on the Great Lakes and the Mississippi and its tributaries. More freight cars equipped for the shipment of bulk cement have been put into service. Cement was first shipped during the year, on an experimental basis, in bulk-cement containers built for shipment on gondola cars, and much additional equipment for pumping cement from cars or vessels to storage bins has been placed into service.

Vibrating large-aggregate concrete with electric-driven tampers, on Calderwood dam

New Practice in Floor Construction

Revised specifications for the placing of terrazzo floors are under preparation by the National Terrazzo and Mosaic Association.

A new procedure in placing and finishing the topping of concrete floor construction, based on actual experience, has been developed by Committee 802 of the American Concrete Institute. The methods recommended are in some respects a definite departure from common practice, and should result in eliminating the inherent defects of former methods. The new procedure is described and illustrated in CONCRETE in the issues of May (pages 33 and 34) and June (pages 31 to 33), 1930, and the specifications appear in the August issue, pages 37 and 38.

Concrete Form Work

Unquestionably the outstanding contribution to concrete form work in building construction was the series of articles by A. B. MacMillan, printed in each issue of CONCRETE from January, 1930, to January, 1931, inclusive. The entire series is now available in reprinted form in a single volume. An appendix covers details of form work for architectural concrete.

Increasing use of metal forms in concrete building construction is also clearly evident, and concrete form work is emerging from its former role as one of the most uncertain elements in cost estimating.

Concrete Bridges

Several notable events occurred during 1930 in the realm of concrete arch bridge design and construction.

October 9 saw the official opening of the 3-span reinforced concrete arch bridge across the estuary of the River Elorn, at Brest, France. The arches, measuring 610 feet from center to center, are the longest reinforced concrete arch spans in existence.

Another event of importance was the winning of first and third prizes in the Phebe Hobson Fowler Architectural Award by designers of concrete arch bridges. (See CONCRETE, September, 1930, page 16.)

Great Concrete Dams Under Construction

Among the greatest concrete structures, in point of massiveness and quantities of concrete used, several dams, either completed or under construction during 1930, hold a prominent place. These include the Chute-a-Caron dam, 125 miles north of Quebec, requiring 460,000 cu. yd. of concrete; the dam under construction at Ariel, Wash., in which about 270,000 cu. yd. of concrete will be required; the Owyhee River dam, in Oregon, utilizing 540,000 cu. yd.; and the Calderwood dam, in Tennessee, now in service, containing 250,000 cu. yd. of concrete. The Hoover dam, formerly known as the Boulder dam, for which bids are to be opened on March 4, will require some 3,400,000 cu. yd. of concrete in the dam alone.

Improvement in Building Regulations

As reported in an article in the April, 1930, issue of CONCRETE, pages 37 to 38, the American Concrete Institute's Building Regulations for Reinforced Concrete have been adopted by fully 100 cities. To this extent uniformity has been attained. Unfortunately, in the largest two cities—New York and Chicago—where new building codes are contemplated, actual adoption of the proposed new codes seems no nearer than it was a year ago. In both cities the codes, if or when adopted, will contain essentially the A. C. I. regulations in the chapters on reinforced concrete.

The Construction Outlook

Considering present conditions and trends and past performance, it seems reasonable that for 1931 a slightly greater volume of residential building construction than in 1930 may be expected, while non-residential building construction is likely to fall below 1930, at least during the first half of the year.

Chicago & North Western Establishes Quality Control of Concrete

Method in Effect Three Years—Course of Instruction Paves Way—Testing Equipment, Water Measuring and Time Control Devices Are Items of Contractors' Equipment

By O. F. DALSTROM
Engineer of Bridges, Chicago & North Western Railway, Chicago, Illinois

Here is a story, told exceptionally well, of how the bridge department of a great railway system established the water-cement ratio method of controlling the quality of concrete.

Succeeding issues will contain the "Instructions for Designing Concrete Mixtures" and "Instructions to Inspectors" issued by the railway company for the information of contractors as well as for the company's own engineering and inspection forces.—The Editors.

IN March, 1928, the Chicago & North Western Railway Company adopted new specifications for concrete work, using the water-cement ratio as the basis of design for concrete mixtures. These specifications followed, in general, the specifications adopted and published by the American Railway Engineering Association, which now form a part of the A. R. E. A. Manual.

Introducing the New Way of Making Concrete

The new specifications differed to such an extent from those previously in use that it was decided to lay out a program of procedure to insure that the specifications would be properly understood and interpreted in the division offices, and put into effect properly by the field forces. With this object in view, the following measures were taken: (1) A copy of the specifications was sent to each contractor when invited to bid on the 1928 work, with a letter calling special attention to the fact that the old specifications were no longer in force and that bids should be based on the new specifications; (2) a special set of instructions on design of the mix was issued to division engineers, contractors and inspectors to accompany these specifications; (3) *Instructions to Inspectors,* covering

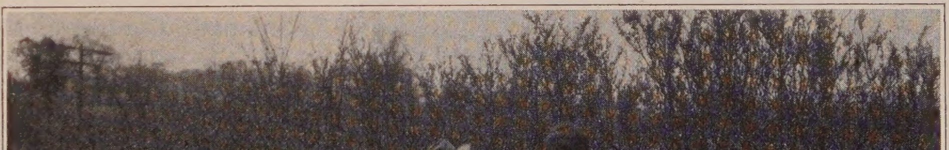


Figure 1. Complete set of field testing equipment

methods to be followed in the field in making determinations, designing and controlling the mix, and in making, shipping and reporting test specimens; (4) requirements regarding water-control equipment on the mixer.

The *Instructions for Designing Mixes*, and *Instructions to Inspectors*, together with letters of instructions issued from time to time, were found imperative in breaking up old habits which had been acquired during the long period of arbitrary proportioning of concrete materials. It was anticipated that considerable reluctance would be manifested by contractors, inspectors and others who would dislike to change the methods and habits of thought acquired during long experience; also that contractors might object to the expense of providing the necessary additional equipment.

Course of Instruction Paves Way

In order to give the specifications the most advantageous introduction possible, arrangements were made with the Railways Bureau of the Portland Cement Association to give a course of instruction to the railway inspectors and assistant engineers. A number of the employes from the Bridge Engineer's office also attended this course of instruction, which covered two full days. The contractors were also invited, and they sent their superintendents or foremen to take this course.

ITEMIZED LIST OF FIELD TESTING EQUIPMENT REQUIRED, WITH APPROXIMATE COST AND PLACES AVAILABLE

Item and Description:	Approx. Cost:	Made or Furnished By:
1 Set of Tyler brass frame sieves, 8-in. diam., consisting of the following sizes: 1½-in., ¾-in., ⅜-in., No. 4, 8, 14, 28, 48 and 100, with pan and cover.	$40.00	W. S. Tyler, Chicago, Illinois.
1 1/10 cu. ft. measure (6 in. diam. x 6 1/10 in. deep) made of No. 11 galvanized metal.	$2.25	Tarpenning-LaFollette Co., Indianapolis, Ind.
1 Slump cone (12 in. high, 4 in. diam. at top, 8 in. diam. at bottom) made of No. 16 galvanized metal.	$3.00	
1 1000-Gram Scale (Dietetic Scale No. 1050).	$6.50	Hansen Bros. Scale Co., Chicago, Ill.
1 20-lb. Scale (No. 1930).	$6.50	
1 Cast aluminum sugar scoop, No. 4-E-1536.	$1.25	Albert Pick & Co., Chicago, Ill.
1 500 cc. (or 1000 cc.) graduated cylinder.	$2.00	E. H. Sargent & Co., Chicago, Ill.
1 Mason's trowel, 10-in., Catalog No. 32.	$1.30	Hibbard, Spencer, Bartlett & Co., Chicago, Ill.
3 Drip pans (15¼ x 10¼ x 3¾) Cat. No. 66—page No. 1008.	$1.50 a doz.	
1 Gallon measure.		These can best be bought locally at small expense.
1 Light aluminum pan, about 8-in. diam.		
Prescription bottles, graduated 12 oz. and 32 oz.		
1 24-in. x 24-in. x 4-in. mixing pan.		These can best be made locally.
1 ⅝-in. diam. x 18-in. steel rod.		
Alcohol		Anti-freeze alcohol is O.K. and can be bought in gallon cans locally.
Cylinder forms for test specimens. Paper form 6-in. diam. x 12-in.		American Can Co., Chicago, Ill.
Metal forms 6-in. diam. x 12-in.		Tarpenning-LaFollette Co., Indianapolis, Ind.

One of the engineers of the Bridge Engineer's office was specially assigned to represent the Bridge Engineer's office in the field work, by visiting each job occasionally, or on request from the division engineer or inspector, to clear up any questions regarding the specifications and to pass judgment on materials furnished by the contractor; also to make special inspection of contractor's equipment, giving particular attention to the devices for water-control on the mixer.

When the work actually got under way in the field, it was found that the way had been fairly well prepared by the preliminary course of instruction given, and through the distribution of the specifications and instructions to division engineers, inspectors and contractors. There developed, of course, a considerable number of questions and different interpretations of the specifications, most of which were handled without difficulty.

They were merely questions which would naturally arise in the transition from old and established methods of work to new methods.

First Equipment Short on Water Control

During the first year under the new specifications it was found that nearly all field equipment was without adequate water-control. Such devices as were in use could not be adjusted, or could not be depended on to make delivery uniformly. Considerable trouble was encountered throughout the entire season from lack of proper equipment of this character. With the beginning of the 1929 season emphasis was placed on the necessity for having the contractors' outfits equipped with an approved device for water-control. While there was less trouble on that score in 1929, it was not until 1930 that this condition was wholly corrected. It is now made a matter of rigid inspection on every job before the work is allowed to proceed.

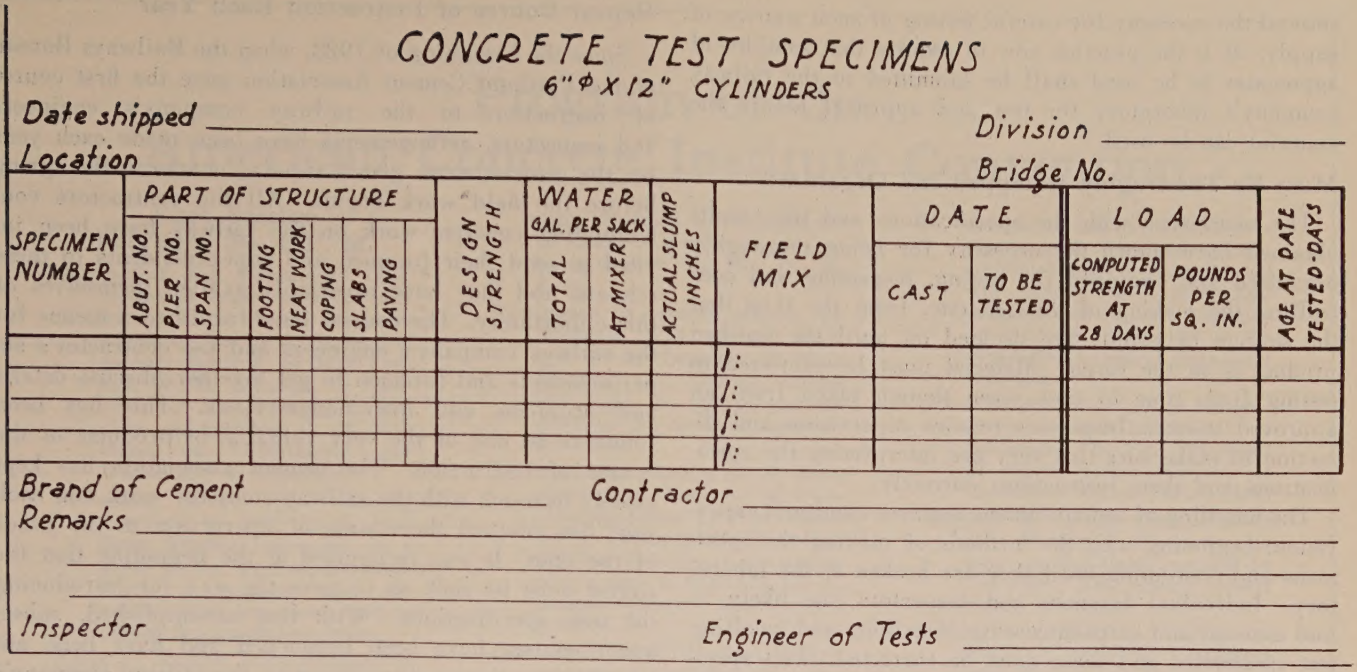
Automatic Control of Mixing Time

During 1929 it became evident that batch mixers with automatic time-control were imperative to secure a specified time of mixing. Where the foreman on the job is under pressure to make the best time possible to keep down the expense, the temptation is ever present to cut down the mixing time below the time specified. The only way to correct this tendency is to provide automatic devices which cannot be tampered with.

Distribute List of Field Testing Equipment

The equipment necessary for the field testing of materials and for designing the mix requires a large number of units, all of which are small, and the aggregate cost of which would hardly exceed $100. Contractors were instructed to provide each outfit with complete equipment. The railway company purchased one complete outfit for the use of the bridge department, but the specifications require that the contractor shall furnish such equipment for his own crew and for the use of the inspector on the job.

Considerable delay was encountered in getting outfits properly equipped. Some contractors were at a loss to find the equipment needed. Others furnished their outfit with units that were not suited for the work or not of the proper size or capacity. A list of testing and design equipment was then made up in the office of the Engineer of Bridges. This list showed just what units were required,



CONCRETE TEST SPECIMENS

6"ϕ X 12" CYLINDERS

Date shipped ____________ Division ____________

Location Bridge No.

SPECIMEN NUMBER	PART OF STRUCTURE										DESIGN STRENGTH	WATER GAL. PER SACK		ACTUAL SLUMP INCHES	FIELD MIX	DATE		LOAD		AGE AT DATE TESTED-DAYS
	ABUT. NO.	PIER NO.	SPAN NO.		FOOTING	NEAT WORK	COPING	SLABS	PAVING			TOTAL	AT MIXER			CAST	TO BE TESTED	COMPUTED STRENGTH AT 28 DAYS	POUNDS PER SQ. IN.	
															1:					
															1:					
															1:					
															1:					

Brand of Cement ____________ Contractor ____________

Remarks ____________

Inspector ____________ Engineer of Tests ____________

Figure 2. Form for laboratory report on test cylinders

where they could be obtained and the approximate cost. Such lists were furnished the contractors, division engineers and inspectors. This removed the complaint about not being able to get the right kind of equipment.

Distribution of Test Reports

The method of handling test reports has been changed considerably during the three years that the specifications have been in force. At first only two copies of the reports were made by the laboratory. One copy was filed in the office of the Engineer of Bridges and the other copy sent to the division engineer. This did not give sufficient publicity to the result. The following year four copies were made, one copy each for the Engineer of Bridges, the division engineer, the inspector and the contractor. Putting this information directly into the hands of the inspector and the contractor stimulated their interest and put them in possession of information by which they could continually guide their work in the field. The effect of distributing the test reports was found so satisfactory that it has become the established practice.

How Test Specimens Are Handled

In order to obtain reliable information on the tests, the test specimens are made in pairs, for every mix. These specimens are numbered in consecutive order throughout each entire job. The odd numbered specimen of each pair is for the 7-day test and the specimen with the following even number is the companion specimen for the 28-day test. Any irregularity in the making or the handling of one specimen would not be likely to occur with the companion specimen. If both specimens in a pair show an extreme trend from normal, this is interpreted as applying to the run of concrete which these specimens represent. A run of concrete in this case means the quantity placed in one operation without any change in the design. Where the work is changed from one grade of concrete to another, or if there is a change in the aggregates or in the mixing conditions, a new design of mix is made up to control the work for these conditions.

Checking Up on Quality of Aggregates

During 1928 and 1929 it became apparent that there was considerable difference in the character and quality of the aggregates being used. A number of tests were made during 1929 to determine the quality of aggregates from different sources. Tests were made to determine the grading of material, quality of stone, and the presence of objectionable substances. Restrictions were placed on the use of material from some sources in 1929, but it was not until 1930 that testing of aggregates was made general and materials from certain sources rejected if they did not conform to the standard of requirements. These tests have uncovered a number of undesirable aggregates and

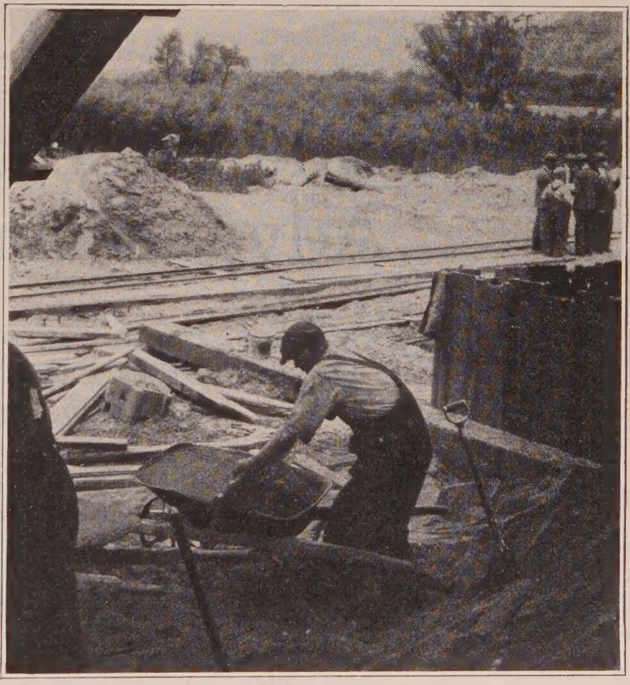


Figure 3. Calibrating a wheelbarrow as aid to accuracy in proportioning

showed the necessity for careful testing of such sources of supply. It is the practice now to require that samples of aggregates to be used shall be submitted to the railway company's laboratory for test and approval before the material can be used.

Must Be Thoroughly Equipped and Organized

The experience with the specifications and the results obtained have shown the necessity for being thoroughly organized and equipped for testing, inspecting and controlling the making of the concrete, from the time that the sources of supply are decided on until the finished product is in the forms. Material must be subjected to testing from time to time, even though taken from an approved source. Inspectors require supervision and direction to make sure that they are interpreting the specifications and their instructions correctly.

The handling of test specimens requires continual supervision, beginning with the methods of making the specimens and continuing until they are broken at the laboratory. Individual foremen and inspectors are likely to find unusual and surprising ways of making and handling test specimens, and these must be corrected. Test specimens have been placed in snow banks to be seasoned, some were placed beside the camp stove, and others were set on the platform of the mixer during the first day, the mixer acting as an effective vibrator. Contractors change foremen and crews from time to time, and when new men who are not familiar with the requirements arrive on the job they must be put through the paces until they know the routine and approved procedure.

Repeat Course of Instruction Each Year

Since the beginning of 1928, when the Railways Bureau of the Portland Cement Association gave the first course of instruction to the railway company's engineers and inspectors, arrangements have been made each year for the association to give a two-day course in the spring before the field work begins. All the contractors contemplating concrete work on the railway have been invited to send their foremen and superintendents to these schools, and they have invariably availed themselves of this opportunity. The courses have furnished a means for the railway company's engineers and the contractor's superintendents and foremen to get together, discuss details and problems and interchange views. This has been found to be one of the very valuable by-products of the course of instruction. The cement association has kept closely in touch with the railway company work and each year has adapted the course of instruction to the needs of the time. It was recognized at the beginning that the course must be such as to pave the way for introducing the new specifications. With that accomplished, subsequent courses have been broadened and have been adjusted to conditions encountered on the railway company's work. Instructions emphasize means of securing uniformity and economy in a product having the strength and quality specified.

No small measure of credit is due to the cement association for the success the railway company has had in putting the specifications into effective use, and in the results that have been secured to date.

American Concrete Institute Members Advance on Milwaukee

Six Sessions, Beginning on February 24, Include Valuable Papers—Other Organizations Meet Concurrently—Tentative Program in Detail

CONCRETE Convention Week at Milwaukee, Wisconsin, will open on February 23 with a joint meeting of the Concrete Masonry Association and the Wisconsin Concrete Products Association, followed by the first of the American Concrete Institute's sessions which begin on February 24.

The Concrete Institute will celebrate the passing of a quarter century since the second annual convention of its predecessor society, the National Association of Cement Users, in Milwaukee in January, 1906.

Registration and Arrangements

Registration will open in the foyer of the Grand Ballroom at the Schroeder Hotel on the 23rd. The evening of the 25th will be given over to the Institute's informal dinner, in which the Milwaukee Engineering Society will join. Duff A. Abrams will make the brief "annual address of the president," present a medal for the most meritorious paper given to the 26th annual convention and "turn the occasion over to subject matter entirely foreign to concrete, in which the Milwaukee Committee is co-operating energetically," the Institute announces. The committee is headed by Kenneth H. Talbot, chairman, and Berry E. Brevik is secretary.

Reduced Rates

Railroads in general are co-operating with reduced fares on the certificate plan, so that members of the Institute and dependent members of their families may make the round trip for fare and a half.

Program Announced

The convention of the Institute will begin with a session at 2 o'clock, on February 24. The tentative program, as announced by the Institute, is given on the following page in detail.

Program of the American Concrete Institute Convention

First Session
February 24—2 P. M.

Admixtures and Workability. Discussion of these two allied subjects will be based on three papers by George A. Smith and Sanford Benham, by Inge Lyse and W. R. Johnson, as published in the *Journal* for January, and by Prof. G. M. Williams, on "Admixtures and Workability of Concrete."

Extracting Water After Placing Concrete, by Prof. S. C. Hollister, Purdue University, in a paper on its effect on the properties of concrete and the means which have been used to reduce this surplus moisture.

Value of Integral Waterproofings in Reducing Permeability. C. H. Jumper, National Bureau of Standards, will report the results of an investigation, a portion of which concerns applied coatings.

Making and Placing Concrete in Calderwood Tunnel Construction. W. R. Johnson, formerly of the Knoxville Power Co., now of the Structural Engineering Department, Purdue University, will describe the unusual features.

Second Session
February 24—8 P. M.

Some Long Time Tests of Concrete, a summarization to be presented by M. O. Withey, professor of mechanics, University of Wisconsin, of the results to date in two series of tests to ascertain effects of age and curing conditions on strength of concrete.

Durability of Concrete, based on field surveys of many structures under a variety of conditions, discussed in symposium by members of Committee 801.

Permeability of Gravel Concrete, by Professor D. H. Pletta of University of South Dakota and P. T. Norton of the University of Wisconsin reporting the results of tests involving 2,000 specimens, one-third of them permeability specimens.

Properties of Mass Concrete, report for Committee 108, prepared by Professors Raymond E. Davis and G. E. Troxell.

Design and Control of the Diablo Dam Concrete, a paper to be presented by Herbert F. Faulkner, assistant engineer, City of Seattle, and R. R. Hubbard, construction superintendent.

Third Session
February 25—9:30 A. M.

Shrinkage of Concrete Masonry, supplementing a paper previously presented to the Institute on results of a series of tests, to be presented by W. D. M. Allan.

Continuous vs. Batch Mixers, by Benjamin Wilk, general manager of the Standard Building Products Co., Detroit, throws new light on the subject secured as the result of comparative tests.

Recommended Practice for the Manufacture of Concrete Masonry Units, presented by P. M. Woodworth, chairman of Committee 708, for preliminary discussion, with a view to replacing the institute's present recommended practice.

Cast Stone Standards, Fred Weigel, chairman, Committee 704, tentatively promises a report suggesting possible revision of the Tentative Specifications for Cast Stone.

Specifications for Concrete Burial Vault Manufacture, proposed for discussion by Committee 709, W. D. M. Allan, chairman.

Color in Concrete, by Committee 408, engaged in the preparation of a recommended practice for the use of color in concrete, will present proposed practice on using color in trowelled surfaces.

Fourth Session
February 25—2 P. M.

Aggregates for Road Work, a paper resulting from investigational work done in the last year in Wisconsin in studying sizes and combinations. T. C. Thee, highway engineer, Bureau of Public Roads, will present the leading paper discussing concrete mixtures with multiple aggregates. Discussions by A. L. Hambrecht, state engineer, Wisconsin State Highway Commission, and George W. Langley, county engineer of Sheboygan County.

Consistency Indicator as Means of Control of Concrete Mixes on Road Work, studies briefly reported by Prof. D. E. Roberts of Marquette University.

Design and Operation of Central Mixing Plants, reported by Frank I. Ginsberg, author-chairman, Committee 602.

Grading of Aggregates for Handling on the Job, preliminary report of Committee 205, I. E. Burks, author-chairman.

Fifth Session
February 26—9:30 A. M.

Reinforced Concrete Column Investigation, by W. A. Slater, chairman, Committee 105, presenting a progress report involving a considerable accumulation of data from tests in progress more than a year. Progress report is scheduled for February *Journal* and another or supplemental progress report will probably be available in preprint at the convention to report some later test data.

Time Yield, summarized in a report giving available information on the subject, by Prof. Raymond E. Davis, author-chairman of Committee 109, on Plastic Flow.

Analysis of Design Considerations for Hurricane Exposures in Concrete Buildings, reported by Committee 308, through Albert Smith, chairman.

Mixing and Placing Concrete in Buildings, on which Committee 502, Mixing and Placing Concrete in Buildings, Arthur R. Lord, chairman, will move the adoption of its specifications now tentative, as published last year and discussed in the *Journal* since that time.

Fabricating and Setting Reinforcing Steel, Committee 503, W. F. Zabriskie, author-chairman.

Specifications for Ready-Mixed Concrete, Committee 504, Miles N. Clair, author-chairman.

Concrete Specifications for the Small Job, Committee 506, Arthur R. Lord, author-chairman. The convention will be asked to give tentative adoption to the specifications already published in the *Journal* on these subjects.

Sixth Session
February 26—2 P. M.

Light-Weight Concrete, discussion. Cinders and burned clay, as reported respectively by Committees 203, Einar Christensen, author-chairman, and 204, George E. McIntyre, author-chairman, will be followed by report of Committee 406, Use of Light-Weight Concrete in Buildings, Frank A. Randall, author-chairman, presenting a complete design analysis for buildings of various heights and loadings with various weights of concrete and discussing effects of light material in design itself and on economy of structure.

Unusual Features of Design and Construction of a 20,000,000-Gal. Water Reservoir, described by Arthur B. Morrill, assistant engineer, filtration, Detroit Department of Water Supply.

Use of Cement in Bulk, available information on practice, reported in summary by Committee 607, Herbert Coffman, author-chairman.

Testing Materials Society to Hold 1931 Meeting in Chicago

The annual meeting of the American Society for Testing Materials will be held at the Stevens Hotel, Chicago, Illinois, from June 22 to 26. Development of the program, somewhat different from those of other years, will take into consideration the fact that the meeting is being held in a large city which is the center of an engineering and industrial community.

A joint session is being planned with the Western Society of Engineers, an organization representative of the engineering fraternity in the Chicago district. The program, the Society announces, will be developed so as to be of general interest and according to present plans it will be devoted to a discussion of the significance of specifications in certain major industries of the district.

A regional meeting of the Society will be held in Pittsburgh during the week of March 16th. The meeting will not constitute a business session of the Society but is designed to afford an opportunity for as many members of the Society as possible to meet with members of the district.

Mississippi Valley Highway Officials Meet in Chicago

About 250 delegates are expected at the annual meeting of the Mississippi Valley Conference of State Highway Departments, now convening at the Stevens Hotel, in Chicago, for a 3-day session extending from January 29 to 31, inclusive.

The program of the meeting includes a number of round-table conferences, for the purpose of discussing matters concerning internal and administrative policies as well as technical and construction problems. The membership of the conference consists mainly of state and county highway officials of the Mississippi Valley region.

E. E. Eisermann, secretary of the Cook County Highway Department, 221 N. La Salle Street, Chicago, is in charge of local arrangements for the conference.

Cast Stone Meeting to Be Held Later in Year; Canvass on Activities

A poll of members of the Cast Stone Institute has shown that a majority prefer that its annual meeting be held some time in the future instead of on February 25, at Milwaukee, as had been tentatively planned.

In another canvass also made recently, members were requested to indicate what activities pursued by the Institute during 1931 would be of greatest benefit to them. It was requested that they pick three from a list of eight and suggest others if desirable. The results of the canvass will be made known during February.

Pipe Association Convention to Be Held at Chicago

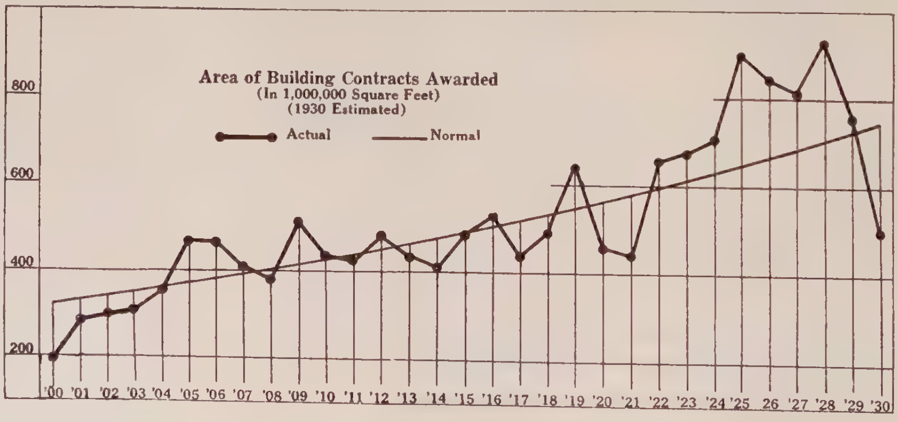
The Edgewater Beach Hotel, Chicago, and February 23 and 24 are the place and time at which the twenty-fourth annual convention of the American Concrete Pipe Association will be held.

Long Term Trend of Building Construction

(Standard Statistics Company)

AN extended analysis of the building construction industry, including a forecast of building activity for the remaining four years of the 5-year period of 1930-1934, has been published by the Standard Statistics Company, Inc.

The chart here illustrated contains a graphic presentation of annual building construction activity back to 1900. The part of the chart extending back to 1915 is based on the reports compiled by the F. W. Dodge Corporation. The further extension back to 1900 is estimated on the basis of other reliable sources of information. The more regular line, slightly curved and sloping upward toward the right, is the computed normal or trend line of building construction activity.



The area between the two curves represents subnormal or supra-normal activity, depending upon whether the curve of actual building construction is below or above the trend line. The extended supra-normal activity in the period from 1922 to 1929 is clearly shown.

In the forecast for the next four years, little improvement is expected for 1931 as compared with 1930, but a sharp upturn is predicted at or near the end of 1931. Such factors as normal real estate credit, improved public purchasing power and virtual absorption of the present vacant housing space are expected to cause the upturn.

~ EDITORIAL ~

Where St. Louis Points the Way

IN a letter prepared for the information of the American Engineering Council at its recent meeting held in New York, R. A. Willis, secretary of the St. Louis section of the American Society of Civil Engineers, has presented a most hopeful summary of the 1931 construction prospects in that city.

Among the large projects listed in the summary are the Illinois Terminal improvement, $12,000,000; Municipal Bridge approaches, $3,500,000; Terminal Mart, $5,000,000; St. Louis and Washington University buildings, $2,000,000; municipal auditorium, $4,000,000; and the new Globe-Democrat home, $1,000,000—a total of $27,000,000 for these six major projects.

This sum, as Mr. Willis points out, is equal to the total building permit values of 1929, and far in excess of the total for 1930. In addition, there is the city's regular program of construction for street paving, sewers, miscellaneous buildings and other improvements.

All this promises well for the construction industry centered in St. Louis; but Mr. Willis reserves the most encouraging part of his summary for the last. He refers to the changed attitude of the public. The new year has brought new hope and the feeling that now is the time to forget 1930 and relieve the present unemployment by going ahead with all possible speed on new construction work.

In this changed attitude St. Louis is setting an excellent example to the rest of the country.

Partners in Progress

CONCRETE products manufacturers are producing and selling great quantities of masonry units and other products made of ordinary stone or gravel concrete. Yet it cannot be denied that in the development of light-weight aggregates the products industry sees its future so far as building units are concerned.

The ordinary stone or gravel building unit will continue to hold its market; but it is largely because of the availability of light-weight aggregates, and the consequent manufacture of light-weight back-up and partition units, that the products industry has been able to invade that great market where the big orders originate.

Unfortunately, the production of light-weight aggregates is still in the early development stage, relatively considered.

It will be fortunate for the future of the products industry if the production of light-weight aggregates can be lowered in cost and expanded over more territory. The next few years may see interesting developments in this direction.

Build Needed Roads to Aid Unemployed

IN this machine age it is interesting to learn that by the time a highway has been built approximately three-fourths of its total cost has gone to labor.

It is estimated that for each man working on the road itself three others are employed at least part time in supplying him with equipment and raw materials.

Road construction in 1930 is estimated to have provided work for 300,000 men directly on the road. Hundreds of thousands of men were also employed in street construction, so that all in all it is clear that accelerated road and street programs will do much toward taking up the slack in employment.

The Federal government is taking the lead by making more money available to the states in the construction of Federal Aid roads which coincide for the most part with the state highway systems. It is expected that the splendid work accomplished by state highway departments in 1930 will be repeated in 1931.

Only Water and Sand Need Heating

IN an abstract of a recent discussion of winter concreting methods, printed in this issue of "Concrete," I. E. Burks and G. D. Durham emphasize several points of direct interest to the contractor engaged in concrete construction during cold weather.

From their extensive experience in winter concreting, these engineers have learned that for temperatures above 15 deg. Fahr. the only material that needs to be heated is the mixing water. For temperatures ranging from 15 deg. above to 40 deg. below zero Fahr., the water and the sand should be heated. It is troublesome, expensive and unnecessary, they say, to heat the coarse aggregates, and unfair to contractors to require this additional and needless expenditure of time and money.

In all cases the concrete needs protection for a period of time; but here, again, it is unfair to the contractor to require him to supply artificial heat for ten days in cases where three days would be sufficient.

Specification writers should be careful to avoid unnecessary and unreasonable requirements in parts of specifications dealing with the placing and protection of concrete in winter. Only in that way can they hope to win the confidence and the willing co-operation of the contractor.

PROGRESS—In a Page

Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.

Progress Report on Load Tests of Reinforced Concrete Columns

A PROGRESS report on load tests of reinforced concrete columns, now being conducted in behalf of the American Concrete Institute, will be presented at the annual meeting of the Institute at Milwaukee on February 26, at the morning session.

The tests are being made in part at Lehigh University and in part at the University of Illinois. It is expected that the final results of the tests will supply the data necessary for the development of formulas for the design of reinforced concrete columns.

Cement Laboratory Inspection by Bureau of Standards

THE CEMENT Reference Laboratory of the U. S. Bureau of Standards has arranged for a second tour of inspection of the cement testing laboratories throughout the country. This service, which at present consists of inspecting cement testing apparatus and demonstrating test methods, is rendered without charge. The laboratories which desire this inspection should make prompt application. Application should be addressed to the Cement Reference Laboratory, U. S. Bureau of Standards, Washington, D. C.

Studying Question of Inspection Service

A NEWLY appointed committee on inspection and testing, representing the Concrete Reinforcing Steel Institute, held its organization meeting in Chicago early in January.

The committee is studying the feasibility of establishing an inspection service having the backing of the Institute. The purpose of this service, if inaugurated, will be that of insuring the quality of billet-steel reinforcement through inspection and certification of quality.

Federal Specifications for Hollow Concrete Masonry Units

COMPLETION of the proposed Federal Specification for Hollow Concrete Masonry Units, mentioned on this page in the issue of October, 1930, can not be expected before March or April, according to information recently received from the Federal Specifications Board, Washington, D. C.

More A. S. A. Standards Available

IN addition to the American Engineering Standards listed on this page in the November (1930) issue, the following three standards having application to the concrete construction industry are included in a list issued under date of December 1, 1930:

A 38-1927—Sizes of Steel Spiral Rods for Concrete Reinforcement.

A 31-1924—Specifications for Materials for Cement Grout Filler for Brick and Stone Block Pavements.

A 6-1925—Specifications for Drain Tile.

Copies of the first of the above publications can be obtained at 5 cents each, and the other two at 25 cents each, from the American Standards Association, 29 West 39th Street, New York.

Wisconsin Industrial Commission Lists Approved Block Manufacturers

The Industrial Commission of Wisconsin has issued a list of concrete block which have been approved for use in load-bearing and exterior walls in Wisconsin under the provisions of the state building code. This list is issued as of January 1, 1931.

Only units that have been properly tested during 1930 and have passed all requirements as to strength, absorption and branding are included in this list.

As the building code requires tests of all units at intervals of not more than one year, it is intended that the products included in this list will be considered approved for 1931, subject to further tests which might be required on reasonable suspicion of non-conformance to code requirements.

The records of the Industrial Commission indicate that a few manufacturers have had satisfactory tests made on the various sizes produced, but in a majority of cases only one or two sizes have been submitted. There are also some manufacturers who have submitted no tests during the year.

Manufacturers are urged to check up on the status of their products, in order that satisfactory test data may be furnished on all units which have not been satisfactorily tested during 1930. Such data should be furnished as soon as possible from samples selected by persons authorized to make such selections.

Model Building Code for Cities of New York State

AT A MEETING held in Syracuse, N. Y., on December 2 and 3, under the auspices of the New York State Conference of Mayors, a committee of building inspection officials was appointed to prepare a model set of city building regulations.

Specification for Concrete Aggregates

FOLLOWING certain recommendations by Committee C-9 on Concrete and Concrete Aggregates, Committee E-10 of the American Society for Testing Materials has approved the publication of the revised "Specification for Concrete Aggregates (C33-28T)."

Profitable Manufacture of Concrete Building Units

Working Out Uniform Production Rate—Estimation of the Coming Year's Business—Effect of Seasonal Deliveries on Stock—Value of Diagrams

III—Scheduling the Output

By **FRED A. SAGER**
Consulting Industrial Engineer

IN the year's business now to be analyzed, a new item of product is to be considered. The call for a unit 2 by 4 by 8 in. was frequent and machinery for its production was installed and a stock made up. Based on estimates of its use, the stock for this item was arbitrarily set at 30,000 brick, or on the basis of 10 solid brick to 1 standard 8-in. unit, 3,000 equivalent 8-in. units. It was further decided to include this item with the five items of major production of the last year, in order that its production should be carefully controlled during its first year of production.

January Stock

The total stock assumed at January 1 is the average minimum stock as determined in Table I[1] for the five items and 30,000 brick, as shown in the top line of Table III. The record given in Table III for the 8-in. units, for example, is in the same form as the daily record kept for each item for each month, and shows as the first figure in the "stock" column, the number of 8-in. blocks on hand on January 1. For the month of January, 6,500 8-in. blocks were made and 18,460 blocks delivered, leaving the stock of 13,040 blocks on hand January 31. Similarly for the five other items, 10-in. plain, 12-in. plain, 8-in. corners, brick and 4-in. plain. Under the division "All Others" is recorded the same information for the dozen or so items made and sold during the year, the quantities in this table being expressed in equivalent 8-in. units, not in number of pieces of product. The same is true for the total business, under the heading, "Total in 8-in. Units," the last section of Table III.

It is seen that the total stock January 1 is 70,000 equivalent 8-in. units, made up of the quantities as determined in Table I[2], for the five major items, the 30,000 brick (3,000 equivalent units) and to make a round number, an increase in the total of Group B[2] from the 10,850 units estimated in Table I[2], to 11,500. In checking this table it should be recalled that the numbers of units in the various items cannot be directly added to obtain the figure in the total section, but must be converted into equivalent 8-in. units before addition is made. Thus each 10-in. plain is taken as 1.25 units; 12-in. plain as 1.5 units; brick as .1 units and 4-in. plain as .5 units. The 8-in. plain and 8-in. corners need not be so converted. For each of the items and for the total, the sales for the year, based on actual experience, are shown in the column headed "Sold."

Assumed Production

It is planned to increase the production of the preceding year to 30,000 units per month for most of the year. During the months of January and February the assumed production is cut to 20,000, allowing for days off during the severest cold weather. It is needless to say here that the production figures under the heading "Made" are not the actual ones. Unfortunately the plant on which the sales figures are based was not running on a uniform production basis and in fact ran day and night during part of the year, became overstocked, ran at a low rate part of the year, became understocked, and at the end of the year had to buy product from another plant to make its deliveries in December. And in any plant operating under the uniform production rate plan, the actual production from month to month will vary with the number of working days per month and with a variation in the rate of manufacture of the various items. Throughout the year, however, the rate of production can be kept uniform and the round figure production assumed in Table III will serve to illustrate the working out of the method.

A glance at the total sales by months (last section of table) shows wide fluctuation in the monthly deliveries, from the minimum of under 3,000 units for February to the maximum of nearly 52,000 units delivered in December. The total deliveries for the year are 342,822 units, which, may it not be asked, agrees too closely with the estimated production of 340,000 units to represent a practical example. It is admitted that in this illustrative problem, with the deliveries known, the author has the advantage in this respect.

Estimation of Future Business

In actual practice it is desirable to estimate the future year's business on data of three or more past years, if the development of the business is regular or is governed by conditions, the effects of which can be reckoned with or allowed for. In such case the records of the years considered can be shown by curves, the continuation of which in the next year serves as the basis for that year's production. Then, as the year progresses, it will soon be apparent whether the actual deliveries are running ahead of or behind the estimated deliveries, and the production program can be altered accordingly. With this explanatory comment, it may be permissible to proceed on the idea that the estimated production "happened" to be fairly close and was not "fixed."

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[1] January issue of CONCRETE, page 18.

[2] January issue of CONCRETE.

Scheduling of Production

The items produced in any month will be determined to a great extent by a knowledge of the business ready for delivery or in immediate prospect. In December of the last year, orders were received for a considerable number of 12-in. block. It had been thought for some time, that the sale of 12-in. block was on the increase and therefore the increase in the minimum stock was provided for this unit, and in the first month the deliveries of the 12-in. units amounted to nearly the total stock on hand January 1. Naturally, heavy production was scheduled for this unit, 9,000 blocks or 13,500 equivalent units. The balance of the month's production is given to 6,500 8-in. units, which production, however, was less than the deliveries of 8-in. block, reducing this stock to 13,997. As February and March had always been months of low deliveries, this reduction was no cause for worry.

In February production was arranged to increase the stock of 12-in. blocks above the minimum requirements by the production of 4,000 block (6,000 units) and by bringing up the 8-in. stock to near normal, 13,000 units, the remaining 1,000 units being filled in in production of miscellaneous items. In March, with small total sales, the only item needing attention was an unusual order for 10-in. blocks, which item had little demand during the balance of the year and the stock of which was allowed to fall and which unit finally went out of production. The main production this month was thrown into the three main items, 8-in., 12-in. and 4-in. plain.

Surplus Production

In the succeeding months the plan in general is to replace the month's sales in the six major items with new production in that item and in the months of low deliveries, to put the surplus production in the heavy moving items, no attempt ordinarily being made to increase the stocks in the "All Others" items. One exception to this occurs in September, when again deliveries were light. At the end of August the total stock was good, presumably sufficient for the fall business. Stocks of 8-in., 12-in. and 4-in. plain were well above their minimums and so an unusual production of miscellaneous items is scheduled at 5,000 units. At the end of September the total stock reaches the highest amount, 119,012 units, with all major items well balanced and an excess, perhaps, in the miscellaneous items.

Fall Deliveries

The following three months with their abnormal deliveries deserve attention. In October the sale of 22,594 of the 8-in. blocks was considered normal and the sale of 4,092 12-in. blocks was below expectation. The delivery of 13,730 of the 4-in. was normal but was only a part of more business in this item required for November delivery. Therefore an unusually large part of October production is in the 4-in. units. And at that, the November deliveries of 4-in. blocks exceeds the 4-in. stock on hand October 31, which necessitates a large production of 4-in. units in November as well. Likewise, trouble was brewing in the matter of 12-in. block whose November sales nearly depleted the stock of October 31, requiring large production of this item in November, notwithstanding which the December deliveries were again larger than the November 30 stock of this unit.

For the purpose of short-time forecasts as to deliveries of product, estimates of prospective orders are continually being revised and orders actually received are checked up with contractors as to dates of delivery and rate at which the material will be laid up by the masons. With this later information production can be arranged so as to have cured product in each item to meet required deliveries in that item.

As a matter of record, the heavy run of 4-in. units in November was fairly well distributed over the month which allowed this item to be provided with cured product by heavy production in October and November. The heavy run in 12-in. block in November and December was

Table III. Product Manufactured, Sold and in Stock by Months for the Year, Expressed in Numbers of Block for Six

Month	8" PLAIN			10" PLAIN			12" PLAIN			8" CORNERS		
	Made	Sold	Stock	Made	Sold	Stock	Made	Sold	Stock	Made	Sold	Stock
			25000			4000			10000			3000
Jan	6500	18460	13040			4000	9000	9000	10000			3000
Feb	13000	2200	23840			4000	4000		14000		12	2988
Mar	15000	3048	35792	1600	3798	1802	4000	1572	16428		792	2196
Apr	17000	15662	37130	800	480	2122	4000	6666	13672		380	1816
May	14000	18690	32170			2122	6000	8900	10862	1000	600	2216
June	11000	11880	31290			2122	8000	6170	12692	1000	280	2936
July	11000	700	41590			2122	6000		18692	1000	800	3136
Aug	18000	18330	41260		300	1822		2132	16560	2000	1844	3292
Sept	15000	8272	47988		100	1722	6000	60	22500	1000	760	3532
Oct	14000	22594	39394			1722		4092	18408	2000	1102	4430
Nov		4470	43924			1722	12000	15640	14768		500	3930
Dec	3000	14610	23314			1722	12000	17260	9508		132	3798
Total	137500	139186		2400	4678		71000	71492		8000	7202	

known in advance and deliveries in November were well distributed over the month.

In December the first five days required delivery of 4,810 12-in. blocks, after which a lull, then delivery of 3,080 blocks from the 11th to the 15th, then no deliveries of 12-in. until the 20th, from which date to the 31st, 9,370 blocks were delivered. By scheduling the production of 12,000 blocks (18,000 units) of 12-in. the first part of the month, cured stock is provided for the entire delivery of the month with 9,508 blocks in stock at the end of the month, all but two or three days' run of which is cured stock. In the latter part of the month 8-in. and 4-in. plain were in production, in both of which items cured stocks previously on hand were ample. The brick stocks are easily handled, as the number produced per day is large and amount of material handled small and as the item is usually made when 4-in. units are being manufactured.

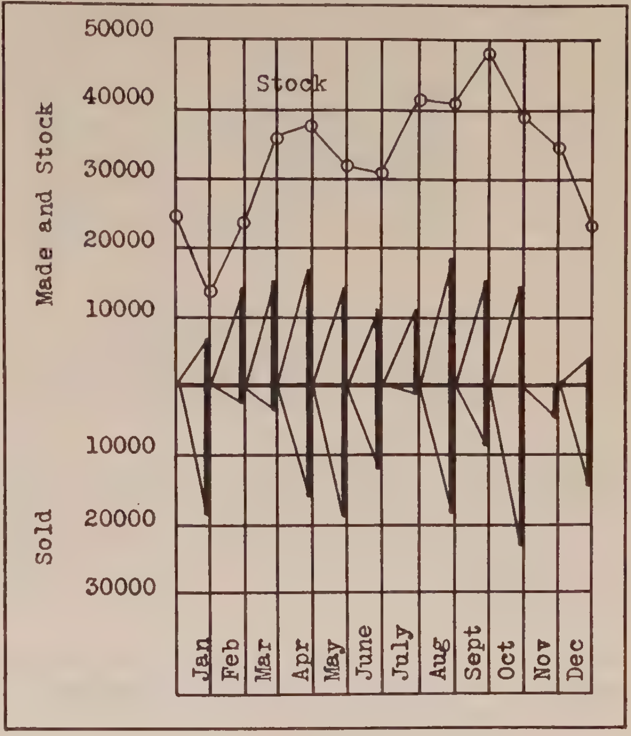
Uniform Production Rate Achieved

And so the year ends with fairly balanced stocks. The 8-in. plain and brick are practically at their estimated minimums, the 8-in. corners and 4-in. plain are above and the 12-in. plain, while nearly at the 10,000 mark set at the beginning of the year, are two or three thousand below the figure at which it was thought best to maintain this item as the year passed. The total stock was about 3,000 equivalent units under the estimated average minimum. The important point is that the production rate throughout the year was uniform and that cured stock was ready for all required deliveries. It is admitted that it is always possible to increase a given month's production by overtime or night work and this reserve production capacity is to be used when needed, even if it results in higher production costs. The burden of this presentation is, however, the fact that wide variations in sales can be handled with uniform production rate.

Projecting Diagrams

For ready reference, the record of manufacture, sales and stocks is desirable in the form of diagrams or graphs since these give the situation at a glance, and when the trend of the graph is known, it can easily be projected into the future to show in an approximate way the expected condition of affairs. For actual use such diagrams can well be drawn to a rather large scale in order that the various curves be well separated and clearly distinguished. But for illustration of the year's business just discussed, Diagrams Nos. 1 to 4 have been prepared in a somewhat different form as to the product "made" and "sold." The stocks on hand are shown in the usual manner by connecting points representing the stock at the end

Diagram 1. Number of 8-Inch Blocks Sold, Made and in Stock, by Months



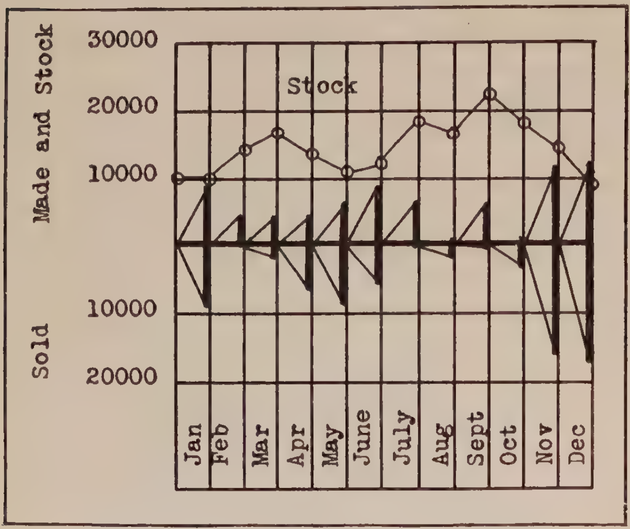
Items of Principal Production and Expressed in Equivalent 8-Inch Units for All Other Items and for the Total Output

BRICK			4" PLAIN			ALL OTHERS			TOTAL IN 8" UNITS			
Made	Sold	Stock	Made	Sold	Stock	Made	Sold	Stock	Made	Sold	Stock	Month
		30000			15000			11500			70000	
		30000		1312	13688		636	10864	20000	33252	56748	Jan
		30000		200	13488	1000	580	11284	20000	2892	73856	Feb
		30000	10000	460	23028	2000	1960	11324	30000	13136	90720	Mar
10000	10200	29800	8000	8396	22632	1000	749	11575	30000	32608	88112	Apr
10000	11000	28800	8000	7240	23392	1000	924	11651	30000	38554	79558	May
10000	1000	37800	8000	5900	25492	1000	951	11700	30000	25416	84142	June
10000	1000	46800	6000	1270	30222	5000	667	16033	30000	2902	111240	July
10000	9000	47800	14000	23728	20494	2000	1919	16114	30000	38430	102810	Aug
	2000	45800	10000	7400	23094		651	15463	30000	13798	119012	Sept
40000	37280	48520	20000	13730	29364		905	14558	30000	41332	107680	Oct
30000	40830	37690	18000	31242	16122		576	13982	30000	48710	88970	Nov
30000	38230	29460	12000	9510	18612		2582	11400	30000	51792	67178	Dec
150000	150540		114000	110388		13000	13100		340000	342822		Totals

of the month by straight lines, this broken line indicating very approximately the stock on hand during the year.

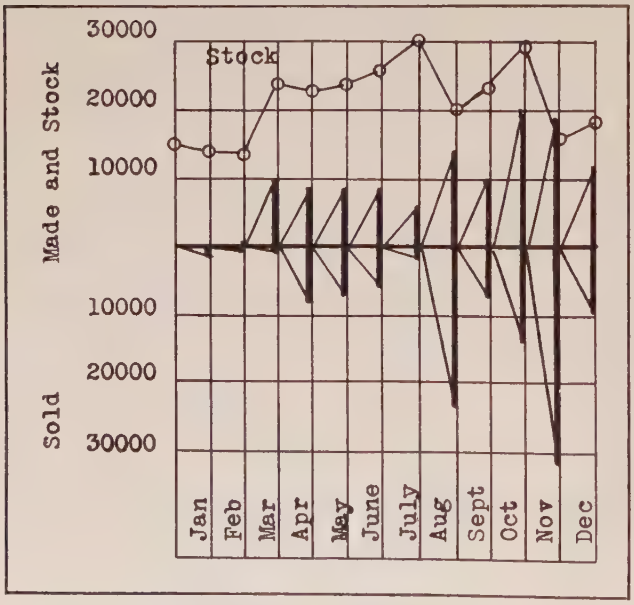
The manufacture of blocks, blocks "made," in the diagrams, is represented by the oblique line, starting at zero at the beginning of each month and reaching, at the end of the month, a height equal to the month's production. By the use of heavy vertical lines, the eye readily detects the monthly fluctuation in production, perhaps as readily as if the monthly production points were connected by straight lines, as is done in the stock curves.

Diagram 2. Number of 12-Inch Blocks Sold, Made and in Stock, by Months



The blocks "sold" are represented in the same manner, except that they are drawn downward from the zero line, first, because on such a small scale diagram it would be confused with the "made" curve if superimposed thereon, and second, because, as related to the stocks, the blocks sold are a deduction from stock and can be properly shown in the negative direction.

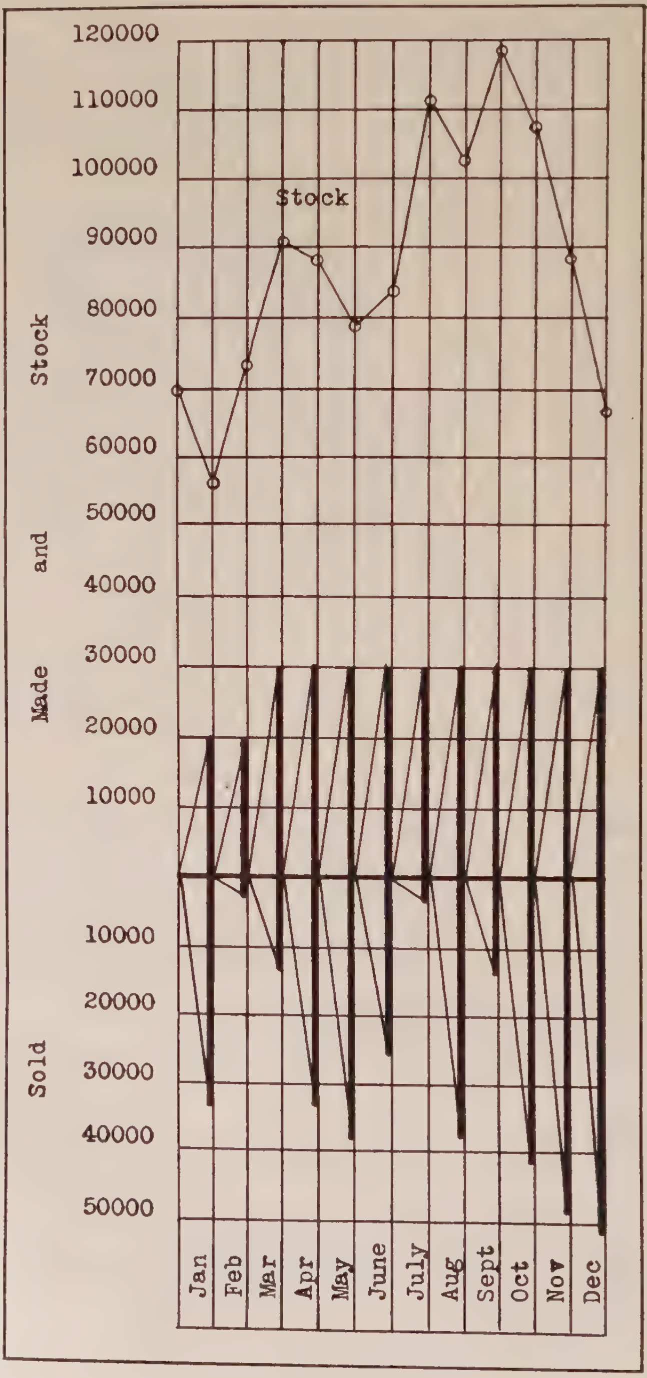
Diagram 3. Number of 4-Inch Blocks Sold, Made and in Stock, by Months



On these diagrams the stock curve is increased in any month by the amount of the blocks "made," drawn upward from the zero line and are decreased by the amount of blocks "sold," drawn downward from the zero line. The objection to reading the inverted sales curve is granted and it may be said that the usual practice is to show the sales curve above the zero line. A more normal view of the sales curve can be had by inverting the chart and looking at it through the paper when held before the light.

With such apology some comment may be made on the use of the diagrams. In each the assumed stock on January 1 was at the proposed average minimum value. If, as is the case in all four diagrams, the stocks are kept in general above this value, the indication is that the business should be promptly handled, and such is the case

Diagram 4. Total Number of Equivalent 8-Inch Units, Sold, Made and in Stock, by Months



so far as the 8-in. blocks and total units, Diagrams 1 and 4, are concerned.

Minimum Stock Raised

In the case of the 12-in blocks, where in November and December the deliveries were in excess of the "minimum stock," the indication is that the minimum should be raised. The same question arises as to the 4-in. blocks, for which the August and November sales exceeded such minimum stock. If such peaks are infrequent the minimum stock can stand and the plant will "get by" on deliveries by proper schedule of production. If peaks of this magnitude become more frequent, such increase in business must be met by proper increase in the "minimum stock" carried.

Referring to Diagram 4 for the total output, it may be noted that the production is at a uniform rate during the year, which makes for economy in production costs; that the deliveries varied widely during the year from the February and July minimums of about 2,900 units to the December maximum of 51,792 units; that with this wide variation in deliveries and with the uniform rate of production the maximum stock of 119,012 units is 70 per cent above the "average minimum" stock assumed.

The average of the total stock carried for the year is 89,169 units or 19,169 above the "average minimum." If, from the average stock of 89,169, there be deducted the 15,000 units of uncured stock, the balance of 74,169 represents the average cured stock carried, which divided into the 342,822 units sold during the year, indicates a turnover of 4.6 times per year.

Now, all the stock over the 70,000 units may be considered as carried to smooth out the production curve. But to keep the stock at 70,000 units, with varying sales, it would be necessary to produce in each month the number sold that month. A glance at the sales curve shows what this would mean. In a plant with limited equipment it would be impractical and in any plant it would be uneconomical. But as a charge against the uniform production rate method of operation, there may be included the interest on the excess of the stock carried over the 70,000 average minimum, which in this case is, on the average for the year, the 19,169 units. If, for illustration, these units be priced in the yard, at 11 cents each, the investment in this excess stock is $2,108.79 and the interest charge at 6 per cent for the year is $126.53, which is equivalent to a charge of 3/100 cents for each of the 340,000 units delivered.

Storage for Seasonal Variations Warranted

Any plant operator knows that production at a uniform rate effects savings many, perhaps a hundred, times more than the cost of the above storage in excess of the "average minimum." Therefore, storage for seasonal variation in deliveries is in general more than warranted. Further and more detailed reference will be made to this matter under the head of costs and accounts to be discussed later.

Disclose Nature of Haydite Concrete

Test Results Show Many Favorable Structural Properties —Low Modulus of Elasticity Affects Design—Both Sand-Haydite and All-Haydite Mixtures Investigated

VARIOUS properties of structural concrete in which haydite (burned shale or clay) is used as the aggregate, either alone or with sand, are discussed by F. E. Richart[1] and V. P. Jensen[2] in the October (1930) issue of the *Journal* of the American Concrete Institute.

Nature of Information Needed

The authors explain that while light weight is the property usually thought of in connection with haydite concrete, the structural designer and the contractor require information on other characteristics of this material, more especially those affecting strength, durability and ease of mixing and placing. There is a demand for information on proportions necessary to produce a specified strength and workability, and on methods of controlling quality. The designer wants, in addition to data on unit weight and strength, information as to the elastic behavior of haydite concrete and its action in a structure. The effect of the relatively low modulus of elasticity of haydite concrete is of importance, and may have a considerable influence upon the economy of design.

Tests Conducted by the Authors

The data published by the authors and the conclusions drawn are based on a series of tests conducted by them at the materials testing laboratory of the University of Illinois.

Proportions Used in Tests

In the conclusions that follow, reference is made to "C"-haydite concrete and all-haydite concrete.

The "C"-haydite concrete was a mixture of coarse haydite and sand, and the all-haydite concrete was a mixture of fine and coarse haydite, the proportions between fine and coarse material in each case having been 45 parts of the fine to 55 parts of the coarse.

The coarse haydite was the size retained on a 7/32-in. screen and passing a ¾-in. screen. The fine haydite, for the all-haydite mixture, was the size passing a 3/16-in. round hole. Both the coarse and the fine haydite were made by the Western Brick Co. at Danville, Ill. The sand used as fine aggregate in the "C"-haydite mixture was a torpedo sand from Covington, Ind., having a fineness modulus of 3.08, a unit weight of 106 lb. per cu. ft. measured loose and dry, absorption of 1.0 per cent, by weight, and a specific gravity of 2.67.

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[1] Research associate professor of theoretical and applied mechanics, University of Illinois.

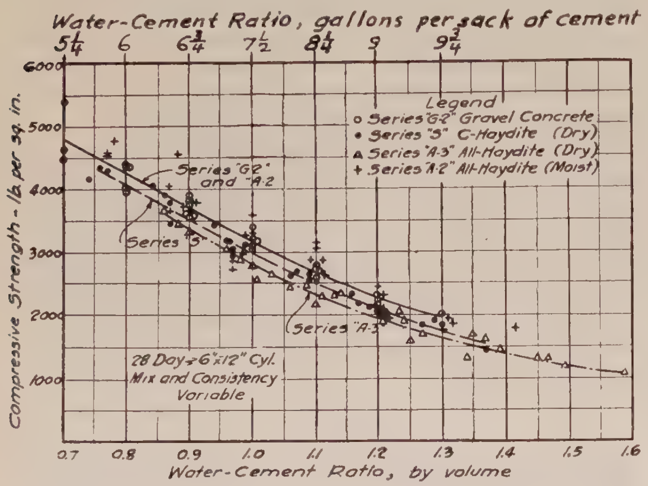
[2] Research assistant in theoretical and applied mechanics, University of Illinois.

Conclusions Drawn from Test Results

The following paragraphs contain the essence of the conclusions drawn by the authors from the test results obtained.

The Water-Cement Ratio

The relation between compressive strength and water-cement ratio of haydite concrete does not differ greatly from that for gravel concrete, all test results falling within a narrow zone, as shown in the diagram. Concretes made with initially moist haydite were consistently a little stronger than those made with dry haydite aggregates. Due to their gradation and surface texture, haydite aggregates in general required a larger water-cement ratio than gravel aggregates to produce a desired workability with a given mix, as indicated by slump and flow tests.



Relation between water-cement ratio and compressive strength for three types of concrete

Correction for Absorbed Moisture

The determination of the water-cement ratio involves an accurate correction for the amount of absorbed moisture. The total absorption of moisture in a given period varies with the initial moisture condition of the haydite aggregate, and is greater if the material is initially moist than if it is dry.

It is recommended that to secure workability the proportion by volume of coarse haydite shall not exceed 55 per cent of the total aggregate. With this proportion, the unit weight of the usual range of structural concretes will be 115 to 120 lb. per cu. ft. for "C"-haydite concrete and 95 to 100 lb. per cu. ft. for all-haydite concrete.

Low Modulus of Elasticity

The modulus of elasticity of "C"-haydite concrete is about 75 per cent, and that of all-haydite concrete about 55 per cent of that for gravel concrete.

With regard to the design of reinforced slabs and beams, there are two features of haydite concrete that are important, the lightness in weight and the low modulus of elasticity. The first will permit considerable reductions in dead load compared with ordinary concrete, thus permitting a reduction in size of members or an increase in span, as well as decreasing loads on columns and footings.

How Elasticity Affects Design

The effect of low modulus of elasticity in a reinforced concrete beam or slab is to lower the neutral axis and to require a higher percentage of steel for balanced reinforcement. However, the depth of member may be decreased so that the saving in concrete quantities will offset the increase in steel requirements.

Combining the effects of light weight and low modulus of elasticity and taking advantage of possible reduction in slab depth, it is found that the substitution of "C"-haydite for gravel concrete will permit a decrease of 12 to 9 per cent of concrete with an increase of 5 to 8 per cent of steel. With all-haydite concrete there may be 20 to 15 per cent reduction in concrete with 11 to 17 per cent increase in steel. In rectangular beam design the conditions are even more favorable to the use of haydite concrete.

Working Stresses

The working stresses for bond and diagonal tension apparently may be taken as the same percentage of the compressive strength as is usually recommended for ordinary concrete.

The values of modulus of elasticity found for gravel concrete do not agree particularly well with the design values specified by the A. C. I. Joint Building Code, except at strengths of 3500 to 3750 lb. per sq. in. Use of the code formula, modified by the introduction of 75 and 55 per cent for "C"-haydite and all-haydite concretes will produce considerable error for concretes of very high or very low strengths.

Influence on Column Design

Despite the implications of the current column formulas, such as that of the Joint Building Code, the low modulus of elasticity should not be used to justify any increase in working stresses in haydite columns over those for gravel concrete. Using concrete of equal compressive strength, equal ultimate column strengths will result. The smaller stiffness of haydite columns may be of advantage in decreasing column moments in rigid frames and like structures.

Other Features of Haydite Concrete

Because of the variation of construction costs in different localities, no attempt has been made to carry the foregoing studies through to the ultimate cost of any structure. However, enough has been given to indicate the variation in quantities to be expected in certain common structural members. Other less tangible features of the haydite concrete structure may lie in the possibility of increased building heights, the use of cheaper types of footings, the possibility of greater panel sizes, and the utilization of insulating properties of the material. The saving of weight in a structure such as in a bridge floor or in a long span roof is of very obvious advantage. Both the properties of the material and its economy in design remain to be explored more fully.

Discussion by Herbert J. Gilkey[3]

A recent paper by Richart and Jensen reports that haydite concrete having an ultimate strength and bond resistance about equal to those of concretes from ordinary aggregates has a modulus of elasticity that is decidedly lower. This fact means that the values of "n" are increased and that a correspondingly higher stress can be transferred to the steel with a given stress in the concrete.

From this very interesting fact it appears that haydite concrete may have unique possibilities in the realm of columns and other reinforced compressive members.

It is probably too late to inject any phase of haydite concrete into the present project[4] even if it were deemed desirable to do so. It does appear that this aspect of the material has enough novelty and promise in it to warrant some sort of a separate experimental reconnaissance over the field.

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[3] Professor of civil engineering, University of Colorado.

[4] The "Reinforced Concrete Column Investigation" being conducted under the direction of Committee 105 of the American Concrete Institute.

Sand and Gravel Men Meet in Fifteenth Annual Convention

Chief among the papers scheduled for presentation at the fifteenth annual convention of the National Sand and Gravel Association, held on January 27, 28 and 29, at the Hotel Jefferson, St. Louis, Missouri, was that by Stanton Walker on "Effect of Size and Grading of Coarse Aggregate on the Strength of Concrete." This was to open the morning session of the 28th.

Other papers scheduled were those on "Utilization of Finer Sizes of Gravel in Concrete Highway Construction," by Bert Myers; "The Use of Separated Sizes in the Proportioning of Concrete for Highway Construction," by R. W. Crum, and "Deleterious Substances in Concrete Aggregates," by F. C. Lang. Stephen Stepanian, chairman, was to present the report of the committee on standard specifications.

Southwest Road Show

The sixth annual Southwest Road Show and School will be held at Wichita, Kansas, February 24 to 27.

Road Builders Attack Many Problems

Machinery Exhibit Smaller Than Last Year — Group Meetings Discuss Special Subjects—County Officials Interested in Secondary Roads—Ready-Mixed Concrete Wins Approval—New Officers

WITH a registration numbering close to 25,000, the Twenty-Eighth Annual Convention and Exposition of the American Road Builders' Association, held in the Arena, St. Louis, Mo., from January 12 to 16, inclusive, came well up to expectations in point of success.

While many of the exhibitors displayed varied lines, as usual, others confined their exhibits largely to new equipment units or to those on which marked improvements had been made.

Bulk Cement Equipment in Evidence

Equipment for handling and storing bulk cement was in evidence on all sides, clearly demonstrating the rapidly developing interest in the use of cement in bulk. Other lines that appeared in many displays included plant equipment for ready-mixed concrete production, transit-mixer truck bodies, weigher-batching equipment, and pavement finishers.

Meetings of Separate Groups

The convention itself was conducted, as usual, in the form of a number of group sessions, where papers and discussions pertaining to the various subjects were heard.

Contractors' Session

The sessions of the contractor group heard papers and discussions on matters such as the effect of state aid to counties, highway maintenance by contract, and details regarding the operation of the Bureau of Contract Information sponsored by the Associated General Contractors. The discussions included a symposium on the future of highway contracting and another on the relation between increased highway expenditures and employment.

City Officials Discuss Design and Construction

The city officials' division listened to a number of papers dealing with finance and administrative matters, but these meetings also saw the presentation of papers on street capacities, the traffic capacity of the Holland tunnel, and a report containing the conclusions and recommendations of the committee on maintenance, the last-named having been presented by the chairman, A. T. Rhodes, superintendent of streets and sewers, Leominster, Mass.

Grade Crossings Given Attention

R. H. Baker, Tennessee state highway commissioner and chairman of the committee on grade crossings, presented a report before a special session on grade crossings. Both the report and the discussions from the floor stressed the importance of formulating a progressive program looking toward the separation of grades at highway intersections and at highway-railway crossings.

County Officials Discuss Secondary Roads

It may safely be said that the papers and discussions on single-lane secondary roads, which constituted much of the program of the county highway official's division, developed more interest than any other subject discussed in the special sessions.

While some speakers advocated the use of gravel, macadam, or similar classes of construction for these secondary county highways, others emphasized the importance of building them of more permanent and substantial construction, equal in every respect to the quality of construction employed in state highway pavements.

Two short papers of exceptional interest on this subject were presented by Forrest Fisher, superintendent of highways of Champaign County, Illinois, and by A. L. Allen, county engineer of Richland County, Ohio. Both these speakers stressed the importance of locating one edge of the single-lane concrete pavement at the center line of the road. This allows ample room for the maintenance of a single-lane roadway of gravel or similar type on the other side of the center line. More than that, it permits the eventual widening of the concrete pavement to the full two-lane width by the simple process of laying the other half of the pavement.

In Champaign County, Mr. Fisher explained, the cross-section of the concrete slab is exactly the same as one-half of the cross-section of an 18-foot state highway, except that the pavement is thickened along the edge next to the center line of the roadway as well as along the outer edge.

Costs in Champaign County are averaging about $14,500 per mile, including the 9-foot concrete pavement, grading of the entire roadway and building of structures. It is estimated that the cost of the later addition of the 9-foot slab on the other side of the center line will average about $9,500 per mile. This, the speaker asserted, is the amount that must be spent every six or seven years for the maintenance of the unpaved half of the roadway.

In Richland County, Ohio, the secondary concrete roads described by Mr. Allen were built in the period from 1922 to 1924. The paved part of the roadway consists of slabs of 1:2:3½ concrete, 10 feet wide and 8 inches thick, with the inner edge located one foot over the center-line. Later widening to 18 feet will center the widened pavement exactly on the center-line of the roadway; and in the meantime the 10-foot single-lane pavement will provide safer driving than a 9-foot width.

Costs in Richland County varied from $12,000 to $15,000 per mile for grading, paving and structures. The contract prices for the concrete slab alone ranged from $1.65 to $2.10 per square yard.

Ready-Mixed Concrete Approved

The use of ready-mixed concrete was approved for all types of construction, in a committee report presented before a special session on central and truck-mixed concrete. Permission has been obtained to print a condensed abstract of this interesting report in a later issue of CONCRETE, in which the essential conclusions and points emphasized in the discussion will be given. The report was presented by the committee chairman, Col. R. Keith Compton, director of the department of public works of Richmond, Va.

Connecticut Man Elected President

The new president of the American Road Builders' Association is William R. Smith, contractor, Meriden, Conn. Samuel Eckels, chief engineer of the Pennsylvania department of highways, was elected vice-president, northeastern district; H. G. Shirley, state highway commissioner, Richmond, Va., was elected vice-president, southern district; and S. F. Beatty, of Chicago, was elected vice-president of the central district.

Otto Hess, engineer-manager of the Kent County Road Commission, Grand Rapids, Mich., was named president of the county highway officials' division, and George B. Sowers, commissioner of the division of engineering and construction, Cleveland, Ohio, was elected president of the city officials' division.

National Crushed Stone Meeting Held at St. Louis

The program of the National Crushed Stone Association, held at the Hotel Jefferson, St. Louis, Missouri, from January 19 to 22, was to open with the Manufacturers' Division exposition on the evening of the 19th.

Among the papers scheduled was a committee report on accident prevention by A. L. Worthen, chairman, and another by T. J. Quigley, chief, mines and quarries section, Department of Labor and Industry, Pennsylvania, on "The Control of Accidents." Charles M. Upham, engineer-director of the American Road Builders' Association, was scheduled to deal with the highway field, stressing the secondary road problem.

A. G. C. Meeting

The twelfth annual convention of the Associated General Contractors of America was to be held at the St. Francis Hotel, San Francisco, on January 26.

Coming Conventions

February 4-6—Engineering Institute of Canada, forty-fifth annual meeting. Windsor Hotel, Montreal, Quebec.

February 23-24—American Concrete Pipe Association, twenty-fourth annual convention. Edgewater Beach Hotel, Chicago, Illinois.

February 23-26—Concrete Masonry Association and Wisconsin Concrete Products Association, joint annual convention. Hotel Schroeder, Milwaukee, Wis.

February 24-26—American Concrete Institute, annual convention. Hotel Schroeder, Milwaukee, Wis.

February 24-27—Southwest Road Show and School, sixth annual meeting. Exposition building, Wichita, Kansas.

March 16-18—Concrete Reinforcing Steel Institute, seventh annual meeting. Edgewater Gulf Hotel, Biloxi, Mississippi.

April 21-24—Building Officials' Conference of America, seventeenth annual meeting. Toronto, Ontario, Canada.

April 27-30—National Terrazzo and Mosaic Association, annual convention. Biltmore Hotel, Atlanta, Georgia.

May 12-16—National Fire Protection Association, annual meeting. Toronto, Ontario, Canada.

June 22-26 — American Society for Testing Materials, annual meeting. Stevens Hotel, Chicago, Illinois.

Only Water and Sand Need Heating in Cold Weather Concreting

Expensive and Unnecessary to Heat Coarse Aggregates—Hot Water Alone Is Sufficient Down to 15 Deg. Fahrenheit—Cold Weather Protection on Chute-a-Caron Dam

By I. E. BURKS[1] and G. D. DURHAM[1]

This valuable information on the heating of materials and the protection of concrete work is abstracted from a discussion by the authors in the November (1930) "Journal" of the American Concrete Institute, the discussion having reference to the report of A. C. I. Commitee 604, on "Recommended Practice for Winter Concreting."

Both of the authors have had extensive experience in placing and protecting concrete during intensely cold weather.—The Editors.

IT was not so very many years ago that constructors faced with the necessity of placing concrete in freezing weather, attacked the problem with apprehension and doubt. Today, thanks to the information made available through the experiences of individual engineers and constructors, we are able to attack a concrete job at 30 or 40 degrees below zero with a feeling of absolute confidence in the results—if certain rules of the game are carefully followed.

How Long Is Protection Required?

For the purpose of this discussion it will be helpful to divide all concrete work into two general classes, viz., reinforced frame sections, and heavy mass work. The principles of protection are the same for either of the classes named but the objective may be slightly different. To cure concrete for such a time as simply to protect it from damage by freezing is one objective; to cure it for an additional period in order that it may attain a specified strength at a designated time, is another objective. The first is usually the only requirement in heavy mass work. The second is generally an important and necessary consideration in reinforced frame construction.

In heavy mass construction, the safe protection rule is to provide means of maintaining the temperature of the green concrete, near exposed surfaces, above 50 deg. F. until it has attained sufficient strength to withstand frost action. In general it should have a compressive strength of around 600 to 900 lb. per sq. in. before the temperature within the protection is allowed to fall below 50 deg. F.

Small walls and structural members encountered in building construction offer a very definite structural hazard when subjected to freezing. The problem of protection and curing is to enable these members to obtain their full designed strength before being loaded. In proportion to their mass the surface is great—hence the heat developed by the chemical reaction of the hydration of the cement plus the heat supplied at the mixer, is readily dissipated by the lower air temperatures. Therefore, in thin reinforced frame construction, the forms must be covered and the enclosure maintained at a temperature sufficiently high and for a period long enough to insure the development of the required strength.

Several Types of Form Covering

It is not a difficult matter to work out a satisfactory type of form covering. Charles S. Hill, in his book, "Winter Construction Methods" gives several excellent examples. The methods used at Chute-a-Caron dam are shown in Figs. 1 and 2. It will be noted that practically the same type of covering is used on the small sections (Fig. 1) as on the heavy mass work (Fig. 2). The form sheeting is made of 2-in. lumber and this has considerable insulating value in itself. The covering for vertical faces consists of 4 by 10-ft. panels, burlap and tar-paper covered. These may be nailed to the main form walers, or placed about 18 in. back from the main form to provide a working space for pipefitters. A 1-in. steam line is run around the form at the bottom and at the center of each lift. The opening between the two forms is closed at the bottom to prevent upward draft. The top is covered by tarpaulins. Over large forms the tarpaulins are supported on light frame-work, and coke-burning salamanders are placed in the shear valleys, as shown in Fig. 2.

Controlling the Live Steam

It is recognized that live steam, due to the moisture supplied, provides better curing protection than dry coils. However, it was found necessary to arrange the piping so that both types could be used on this work. If live steam is used while the placing is in progress, clouds of steam prevent the crews from seeing and the work becomes difficult and dangerous. Valves are placed at intervals in the coils so that dry heat may be supplied during the time the form is being filled, and then the valves are opened and live steam supplied when the form is finished and covered.

What Temperatures for Mixed Concrete?

When the air temperature is below the freezing point, necessary arrangements are made at the mixing plant to produce concrete having a temperature of from 70 to 100

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[1] Concrete technicians for the Aluminum Company of America, on the Chute-a-Caron dam project in Quebec.

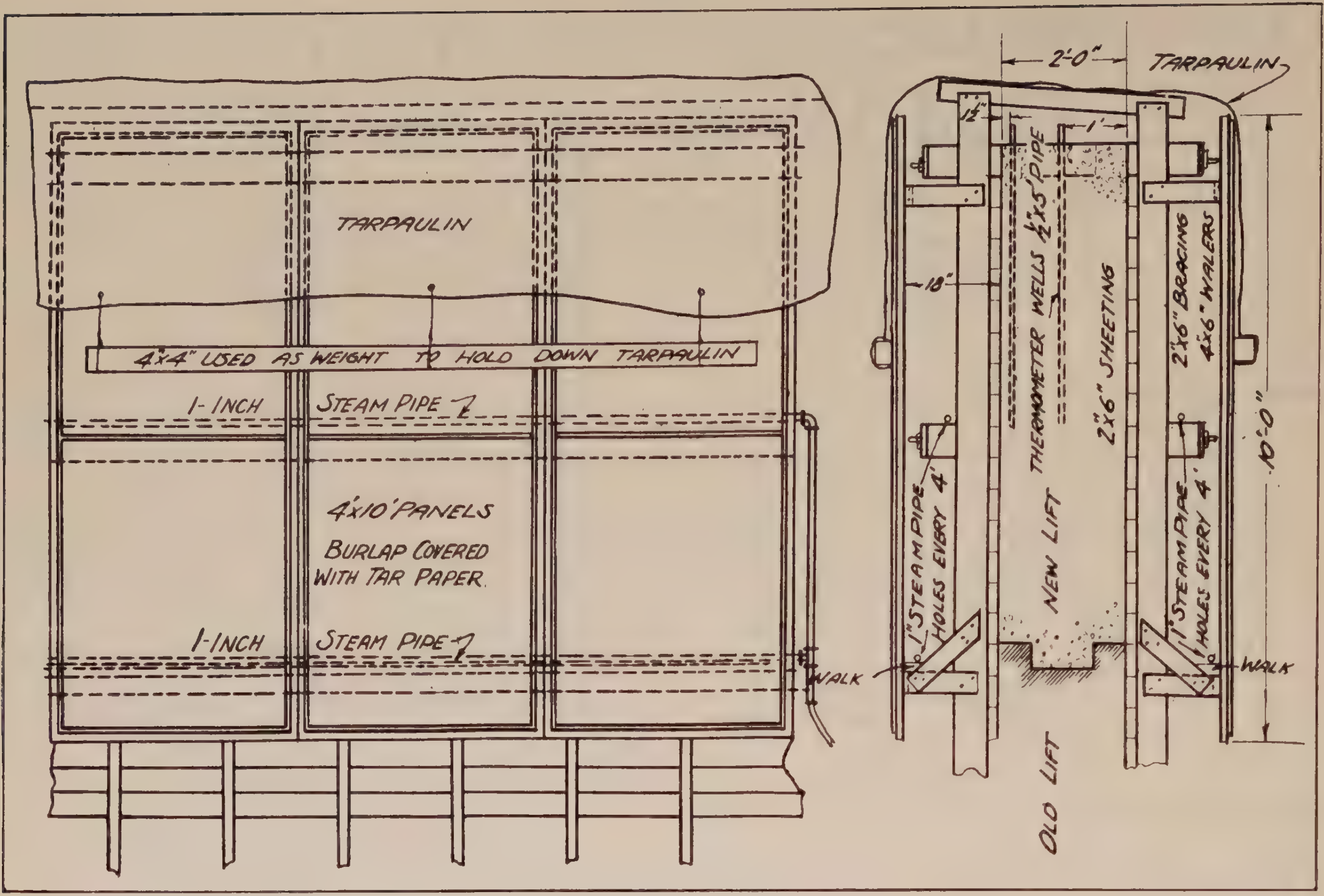

TARPAULIN
4"x4" USED AS WEIGHT TO HOLD DOWN TARPAULIN
1-INCH STEAM PIPE
4'x10' PANELS
BURLAP COVERED WITH TAR PAPER
1-INCH STEAM PIPE
WALK
2'-0"
TARPAULIN
12"
1'
18"
THERMOMETER WELLS ½"x5' PIPE
2"x6" SHEETING
NEW LIFT
OLD LIFT
2"x6" BRACING
4"x6" WALERS
10'-0"
1" STEAM PIPE HOLES EVERY 4'
1" STEAM PIPE HOLES EVERY 4'
WALK

Fig. 1. Method of protecting small sections of concrete

deg. F. It was found that concrete heated to above 100 deg. was in danger of taking a flash-set. On two occasions when the mixture was discharged at 110 deg. the concrete was set up in the buckets before it could be delivered to the forms (a matter of 25 or 30 minutes). It has been suggested that if the cement came into immediate contact with mixing water at a temperature of from 180 to 200 deg., the chance of a flash-set would be much greater than when the mixing water had first been cooled to some extent by contact with the sand and stone. It is the opinion of the authors that there is no advantage in heating concrete higher than to 100 deg. This temperature offers ample

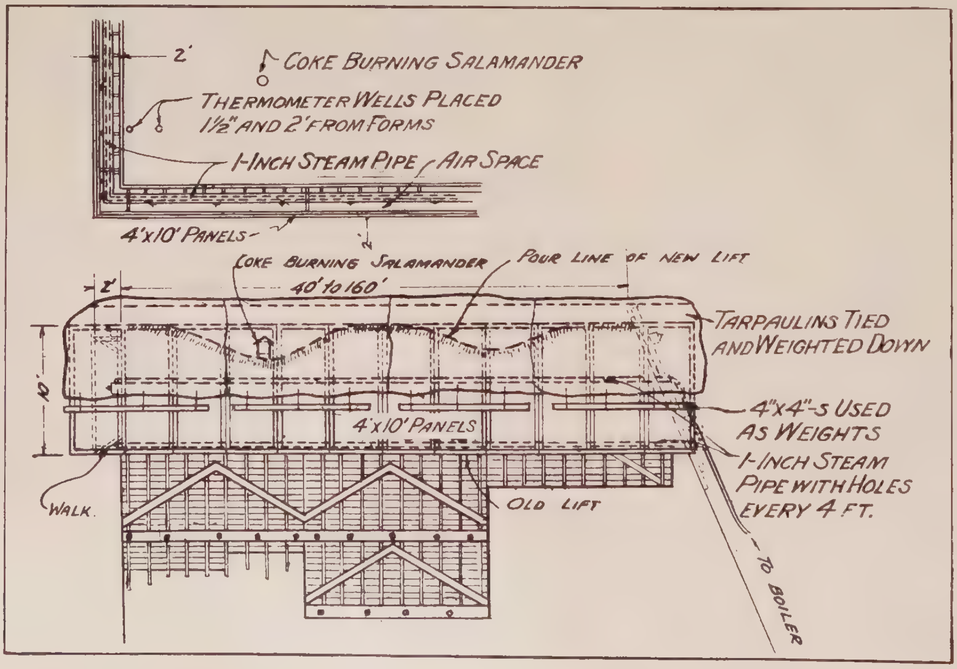


Fig. 2. Method of protecting heavy mass work

protection for any ordinary transportation and placing system and has been found to be quite satisfactory when air temperatures are as low as 40 deg. below zero.

Heating the Sand

The matter of heating aggregates is not a serious problem where proper facilities are provided. It is probably a waste of time and money to try to heat the coarse aggregate at all. If enough stone or gravel is to be used to feed even a 3-bag mixer continually the time and money required to heat this material is out of all proportion to the benefits obtained. Instances are very rare where more than a small portion of the stone particles are ice-coated. The heat of the mixing water alone is enough to thaw any such ice-coating before the concrete leaves the mixer. By using live steam it is a simple matter to heat sand to almost any temperature from 60 to 150 deg. On our work the sand temperature usually runs between 70 and 80 deg.—with the mixing water at from 180 to 200 deg. This combination, together with a 1-in. steam jet in the mixer, will produce concrete at from 70 to 100 deg.

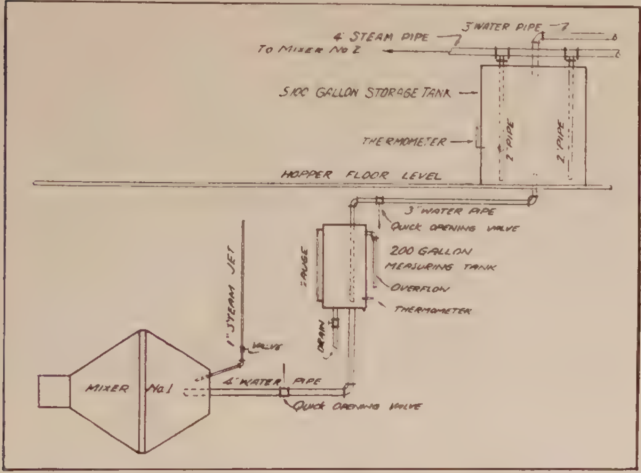


Fig. 3. Arrangement for supplying steam and hot water to mixers

Methods of Heating Water

It has been the experience of the authors that heating the mixing water only, will provide ample protection until the air temperature gets down to about 15 deg. above zero.

The method used at Chute-a-Caron dam for supplying hot water and steam to the mixing plant may be best understood by studying the diagram, Fig. 3. The 4-in. pipe-line, which supplies the steam for heating water in the two 5100-gal. storage tanks, is taken from two 80-h.p. boilers. These boilers also furnish steam for the 1-in. jets in the mixer drums and for the various jets in the sand stock-pile.

The sand in the storage pile is heated by several 1-in. steam jets which are moved about as conditions require. The storage pile is divided roughly into three areas, two of which are being steamed while sand is being used from the third. A sketch showing the sand heating arrangement is shown in Fig. 4.

If conditions do not favor the storage pile arrangement, and it is found more convenient to deliver sand directly from the pit to mixing plant bins, a very satisfactory method of heating is to provide steam jets in the dump cars, as shown in Fig. 5. Eight 1-in. steam jets placed in a 30-yd. car will thaw all frozen lumps and heat the sand to about 100 deg. F. in about 3 hours. If the sand is to be screened before using, an added benefit of heating in the cars lies in the fact that the hot sand prevents the conveyor belts and screens from freezing. The maximum loss of heat caused by handling sand from cars, through the screening plant and into the mixer bins, was found to be about 20 degrees.

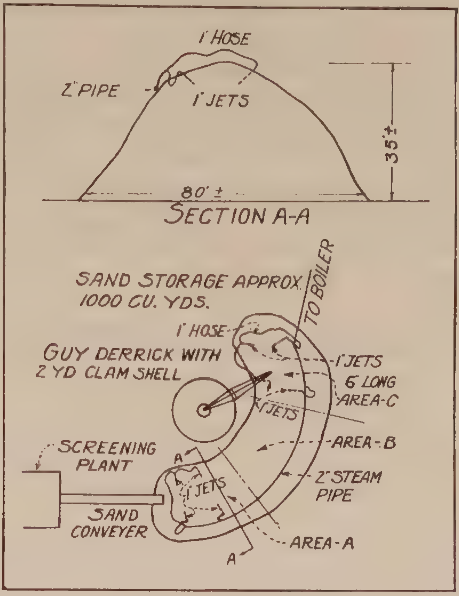


Fig. 4. Method of heating sand in storage pile

While the heating and protection arrangements outlined above have given very satisfactory results at Chute-a-Caron dam, there are doubtless many other methods in use which are just as good, or better. It would be a fortunate circumstance if Committee 604 of the American Concrete Institute could be successful in getting all engineers who are familiar with cold weather concreting work

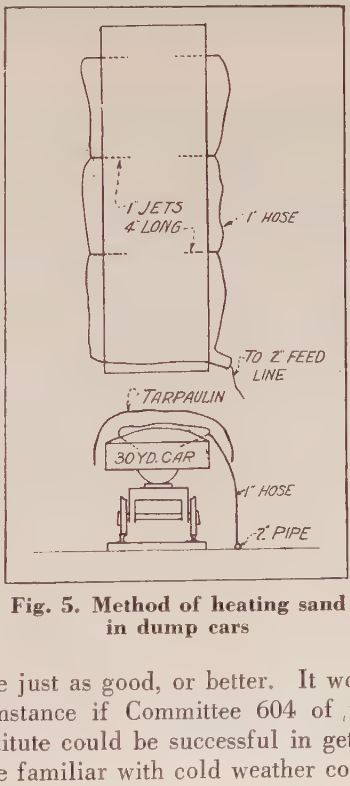


Fig. 5. Method of heating sand in dump cars

to record their experience in order that the most efficient methods could be described in detail and published in the committee's final report. If "Recommended Practice for Winter Concreting" is to be written and sponsored by the Institute, the economic phase should be given very careful consideration. While the ultimate aim of such a specification should of course be to produce concrete of the quality prescribed by the design, the requirements of the specification should be such as to avoid unnecessary expense. A constructor should not be required to keep a section of his concrete work covered and heated for 10 days if 3 days will suffice; neither should he be required to go to the expense of heating aggregates before conditions warrant such action.

Engineers Club to Discuss Concrete in Building Construction

Philadelphia Club to Have Session on Concrete Masonry Units, Concrete in Architecture, Light-Weight Aggregates

A program of unusual interest and broadness in scope has been scheduled by the Engineers Club of Philadelphia for the afternoon and evening of February 17, when a series of papers on "Concrete in Building Construction" will be read and discussed.

An understanding of the wide range of the program and the high quality of the papers to be presented may be obtained from the list of subjects to be covered at the meeting.

The subject of "Concrete Masonry Back-up Units" will be covered in papers by W. E. Rosengarten, engineer for Lower Merion Township, Pa., and Horace T. Campion, consulting engineer, Philadelphia.

"Decorative Concrete" will be covered by John J. Early, architect, Washington, D. C., and Walter H. Thomas, director of architecture, City of Philadelphia. Mr. Early is the well-known sculptor and specialist in decorative concrete work who has many noted works of art to his credit.

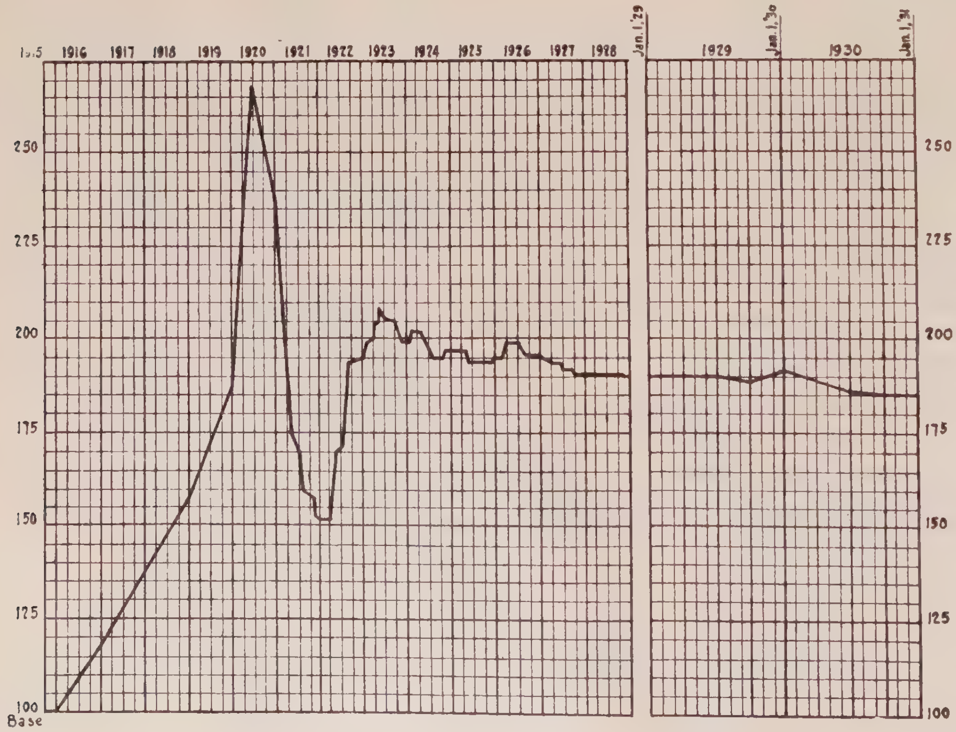
"Influence of Concrete on Architectural Style" will be the subject of papers by Prof. F. S. Onderdonk, of the University of Michigan, and W. E. Hart, manager of the Structural and Technical Bureau of the Portland Cement Association.

"Inspection and Testing of Concrete Structures and Material" is to be treated by Miles N. Clair, of the Thompson & Lichtner Company, Boston, and Meyer Hirschthal, concrete engineer, D. L. & W. Ry., Hoboken, N. J.

"Light-Weight Aggregates" will be discussed by Prof. F. E. Richart, of the University of Illinois, and by A. W. Munsell, engineer for the Port of New York Authority.

"Developments in Design" will be covered under three sub-headings, the first of which is *Tall Buildings*, to be discussed by Frank A. Randall and Arthur R. Lord, both well known consulting structural engineers of Chicago. The subject of *Rigid Frames* will be covered by A. G. Hayden, designing engineer, Westchester County Park Commission, White Plains, N. Y., and by George E. Beggs, professor of civil engineering at Princeton University. The remaining subject, on *Floor Finishes*, will be discussed by John G. Ahlers, of the Barney-Ahlers Construction Corp., New York, and by Charles Schwertner, of the general contracting firm of Sauter & Schwertner, of Philadelphia.

Aberthaw Index of Cost of Building



The January 1st Aberthaw Index of Cost of Industrial Building shows costs unchanged since October 1, 1930. The index figure remains at 185, which represents a cost of $1.94 per sq. ft. of floor area for an industrial building such as the 7-story reinforced concrete structure that is used as the basis for the estimate.

The building is a typical all-concrete structure, 200 by 62 ft., with average story heights.

A year ago the index figure stood at 190. It is believed that the level of 185, which has held for two quarters, represents the bottom, and that further reduction in building costs is not probable. In the present instance, reduction in the price of cement has been offset by an increase in the price of steel.

Joint Products Program at Milwaukee Stresses Merchandising and Selling

Current Problems of Products Man to Be Considered by the C. M. A. and the W. C. P. A.—Sessions Precede Those of Concrete Institute—New Faces Among Speakers

By D. R. COLLINS

SUBJECTS relating to the merchandising and selling of concrete products will exclusively make up the program scheduled for the joint convention of the Concrete Masonry Association and the Wisconsin Concrete Products Association.

The American Concrete Institute, which immediately follows the sessions of the products associations with its meeting, has developed such a fine program of subjects relative to the manufacture of concrete products and has made available so much typical information that it was considered unwise by the committee in charge of the Concrete Masonry Association and the Wisconsin Concrete Products Association programs to touch even remotely on this phase of the business.

The sessions of the convention will start Monday morning, February 23, and all meetings will be held on the 5th floor of the Hotel Schroeder, Milwaukee, in a room especially set aside for the concrete products associations for the entire period of their meetings.

With probably one exception, no one of the speakers has appeared on a Concrete Products Association program for the past five years. The Monday morning session will feature two men new to the associations' convention programs—Henry Bucholz of Franklin Park, Illinois, and Harry H. Potts, Chicago.

The first day's program includes the following:

"The Modern Salesman's Job," by Henry Bucholz, Chicago Insulcrete Company.

"Building a New Main Line," by Harry H. Potts.

"Gearing Your Selling to Your Products," by Dan Servey, Haydite Manufacturers' Association, Kansas City, Missouri.

"Selling Light-Weight Tile," by Nolan Browne, Penniman Concrete and Material Co., Dallas, Texas.

"The Value of Research in Selling," by Einar Christensen, National Building Units Corp., Philadelphia, Pa.

Subjects to be covered on the second day are as follows:

"Developing a Business in Random Ashlar and Interior Units," by Fred Munger, General Cement Products Corp., Flint, Michigan.

"How a Research Program Can Develop Business," by Herman Frauenfelder, Algonite Stone Manufacturing Co., St. Louis, Mo.

"How the Products Man Can Use Direct Mail Advertising," by R. Marshall, advertising counsel, Detroit, Mich.

"Developing Dealer Distribution," by Joseph Apfield, Apfield Concrete Products Company, Bloomington, Ill.

"Digging Tomorrow's Profits Out of Yesterday's Depression," by Austin Crabbs, Cement Products Co., Davenport, Iowa.

The products banquet will be held on the evening of the 23rd.

Future Plans of the Industry

The lines along which the concrete masonry industry is developing its future plans are well known to progressive products manufacturers. These developments are being carried forward through the medium of the Concrete Masonry Association and through the more active state and regional associations, among which the Wisconsin Concrete Products Association is an outstanding example.

Better merchandising, laboratory research and field investigations, and education of the building public, are the foundation stones of this development. It is on the strength of this foundation work that concrete masonry manufacturers must depend for much of their progress during the next five years. True enough, the manufactured product must be sold; but the selling can be made easier and the volume of sales can be materially increased only if the manufacturers keep in tune with these far-reaching plans.

The Concrete Masonry Association is very much alive, as the Milwaukee program well indicates. Co-operation from state associations and individual manufacturers will lead to results far beyond any present developments.

Japanese Investigators Study Properties of Concrete

A 64-page publication, *The Memoirs* of the *Sendai Higher Technical School*, Sendai, Japan, issued under date of November, 1930, contains a series of interesting research papers by Shichiro Uchida, printed in the English language.

The Uchida papers cover subjects such as the effect of previously heated temperature on the modulus of elasticity and the modulus of rigidity of concrete, other studies of modulus of elasticity and modulus of rigidity, the change in volume of neat cement during setting and hardening, the physical properties of portland cement, and an investigation of the relation between age, proportion and compressive strength of concretes. The papers on the last two subjects are printed in both the English and the Japanese languages.

Another paper, by Dipl. Ing. Tomoyasu Yuki, of Sendai, Japan, is printed in the German and the Japanese languages, and deals with bonding values.

American Society of Civil Engineers' Annual Meeting Well Attended

Wide Variety of Papers in Technical Sessions—Chiefs of Government Bureaus Discuss Work—Medals Awarded

The Seventy-Eighth Annual Meeting of the American Society of Civil Engineers was held in New York, at the society's headquarters, 33 West Thirty-ninth Street, New York, from January 21 to 23, inclusive.

A special feature in the afternoon of the first day's session was designated as "Government Day," during which the heads of various government bureaus discussed the work of interest to civil engineers that is now in progress under their direction. These discussions were given by Dr. George K. Burgess, director of the Bureau of Standards; Raymond S. Patton, director of the Coast and Geodetic Survey; Dr. J. D. Sears, administrative geologist of the Geological Survey; Dr. C. F. Marvin, chief of the Weather Bureau; Thomas H. MacDonald, chief of the Bureau of Public Roads; S. H. McCrory, chief of the Division of Agricultural Engineering; Major-General Lytle Brown, chief of engineers, Corps of Engineers; and F. E. Bonner, executive secretary of the Federal Power Commission.

Sessions of Technical Divisions

The various technical divisions held their sessions on January 22, the second day of the meeting.

Construction Division. Papers read before this division included one on the construction features of the Chesapeake & Ohio Railway's new three-span continuous bridge, over the Ohio River at Cincinnati, by Wilson T. Ballard, vice-president of the J. E. Greiner Company, general contractors, of Baltimore. Another paper, by G. G. Wheat, consulting engineer, Brooklyn, N. Y., discussed the mechanical handling of building materials. Construction methods on the Empire State Building and the building at 40 Wall Street formed the subject of a third paper, by Russell H. Hunter, vice-president and general superintendent of Starrett Brothers & Eken, of New York.

Highway Division. Two papers were presented to this division, the first of which was a compilation of papers and discussions on the pre-qualification of contractors, read by C. J. Tilden, professor of engineering mechanics, Yale University. The second paper, by R. W. Crum, director of the Highway Research Board, Washington, D. C., discussed the equitable distribution of motor vehicle license fees and gasoline taxes.

Structural Division. The report of the division subcommittee on "Wind Bracing of Tall Buildings," presented by C. R. Young, professor of civil engineering, University of Toronto, was followed by extended discussion by speakers to whom the subject had been assigned. The structural features of the Empire State Building were described in a paper by H. G. Balcom, consulting engineer, New York. A third paper, on the structural problems involved in the design of the new building for the Bank of Manhattan, was presented by H. V. Spurr, chief engineer of Purdy & Henderson, New York.

Power Division. Papers presented to this division included one by John P. Hogan, consulting engineer, New York, describing the Spier Falls addition to the New York Power and Light Corp. plant on the Upper Hudson River; one by Robert F. Ewald, hydraulic engineer for the Aluminum Company of America, discussing experience with erosion at spillway dams; and a third paper, by G. I. Rhodes, vice-president of Ford, Bacon & Davis, New York, on the use of natural gas for the production of steam power.

Inspection Trips

The third and last day of the convention was taken up by inspection trips to various engineering plants and projects in the metropolitan area of New York.

The new president of the American Society of Civil Engineers, announced at the noon session on January 21, is Francis Lee Stuart, New York consulting engineer.

Canadian Engineers in Forty-Fifth Annual Meeting in Montreal

The Forty-fifth Annual General Meeting and the General Professional Meeting of the Engineering Institute of Canada will be held at the Windsor Hotel, in Montreal, on February 4, 5 and 6.

Among the papers to be presented in the technical sessions of the meeting will be one by I. E. Burks, concrete technician for the Aluminum Company of America, describing special construction features of the Chute-a-Caron dam project on the Saguenay River, in the province of Quebec, about 125 miles north of Quebec. Mr. Burks is known to readers of CONCRETE because of previous papers and articles by him on this and other large power development projects. The paper to be presented by him at Montreal will deal in part with the mechanical problems encountered during the fabrication and erection of the huge lock gates.

The power development project at Alexander Landing, Ontario, on the Nipigon River, is the subject of another paper. This project, the second largest undertaken by the Hydro-Electric Power Commission of Ontario, will bring the total development of the Nipigon River to 120,000 h.p.

Breakwater construction in Port Arthur harbor, now approaching completion, and the construction of the lock gates in the Welland Ship Canal, are other great engineering projects that will be described at this meeting.

The head office of the Engineering Institute of Canada is at 2050 Mansfield Street, Montreal.

Purdue University Annual Road School Meets

The seventeenth annual road school of the Engineering Extension Department was held at Purdue University, Lafayette, Indiana, on January 19 to 23.

Among the papers on the five-day program were those by R. B. Crepps and W. I. Freel, on the sampling and testing of materials; one by S. C. Hollister on making good concrete, and another by E. L. Alexander on improvements in concrete road design.

Fire Protection Meeting

The annual meeting of the National Fire Protection Association is scheduled to be held at Toronto, Ontario, Canada, May 12 to 16.

Concrete Structural Frame Climbs Three Stories Per Week

High-Early-Strength Concrete Attained with Standard Portland Cement—Only Four Sets of Forms Required—Concrete Mixtures Carefully Designed

By CEDRIC WILLSON
Service Engineer, Consolidated Cement Corp.
Kansas City, Mo.

THREE floors a week was the schedule planned by McMillen & Shelton, general contractors, in constructing the 15-story concrete frame of the East Broadway Office building at Enid, Oklahoma. This schedule was easily maintained. Figure 1 shows the carpenters working on the first floor forms; this was July 26, 1930. Concrete was placed in these forms two days later, on Monday, July 28th.

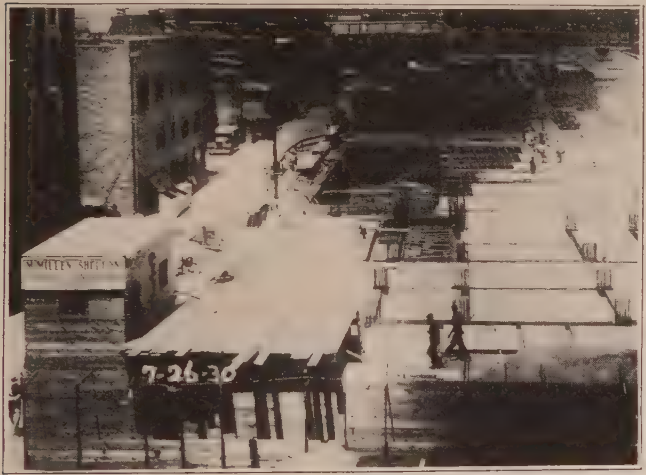


Figure 1. The first floor was concreted on July 28, 1930

Figure 2 shows the completed reinforced concrete structural frame as it looked on September 11th, shortly after the roof slab had been placed.

Counting half-time work on Saturdays and Labor Day, it took 37 sixteen-hour double shift days to complete the concrete frame. This makes an average of one slab every 2.3 working days, or 3 slabs in a 7-day week, just as planned by the contractor.

Design of Concrete Mixtures

In order to maintain this schedule, all concrete mixtures were carefully designed in accordance with strength charts, showing the relationship between the water-cement ratio and the compressive strength of concrete at the age of 1, 2, 3 and 7 days. Standard portland cement was used.

Three classes of concrete were used, in which, respectively, 6, 7 and 8 gallons of mixing water were used for each sack of cement. These mixes were designed to contain 6½, 5½ and 4¾ sacks of cement to the cubic yard of concrete.

Four Sets of Forms

It was calculated that under prevailing weather conditions forms could be stripped in 48 hours, 72 hours, and 7 days, respectively. This quick removal of forms ef-

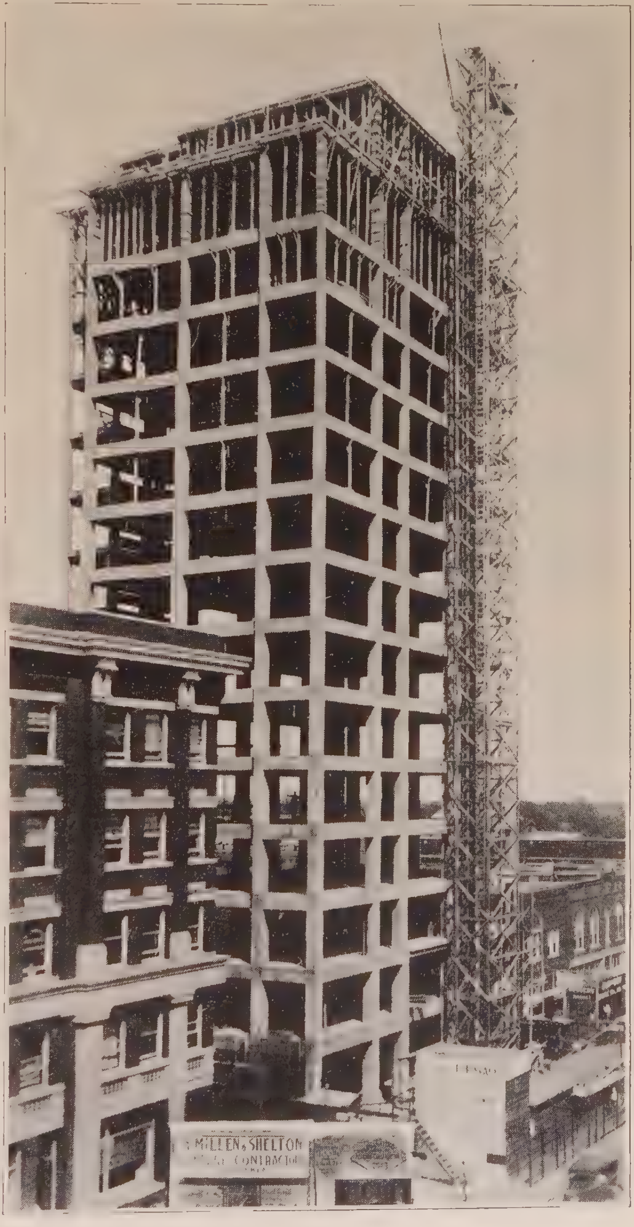


Figure 2. Fifteen-story structural frame completed by September 11th

fected an appreciable saving in lumber. Only four sets of forms were required—that is, enough for four stories of the building. While three of these sets were in use, one set was in the carpenter shop being refitted for the next floor.

Working Strengths in 3 Days

In order to check the designed strengths of the various concrete mixes as obtained from the service chart, test cylinders were broken at 3, 7 and 28 days. Table I shows the average compressive strength, in pounds per square inch, of cylinders made on the job with each class of concrete.

TABLE I

Average Compressive Strengths of Test Cylinders Actually Made Under Job Conditions

Class of Concrete	Compressive strength in pounds per sq. in.		
	3 Days	7 Days	28 Days
8 gallons	--------	1763	2841
7 "	1471	2395	3257
6 "	1921	2803	3812

By this careful attention to the attainment of high early strength the contractors were able to make use of two shifts, thereby taking full advantage of the early working strengths developed. This concrete was made without extra expense, and there was a substantial saving in form lumber. In addition, the time schedule was maintained without trouble.

The architects are Layton, Hicks & Forsythe, of Oklahoma City, and G. E. V. Blumenauer, of Enid, Okla. L. H. Hansen is superintendent of construction for McMillen & Shelton.

Paris Transit Mixed Concrete Men Hold Well Attended Meeting

Quality of Delivered Concrete Considered Subject of Greatest Importance to Industry—Officers Elected

The National Association of Paris Transit Mixed Concrete Manufacturers held its annual meeting in St. Louis from January 9 to 12, the sessions having been attended by more than half the membership. Those in attendance represented more than 75 per cent of the production capacity of the plants operated by the members of the organization.

This organization is a specialized group of operators that meet once a year for the purpose of discussing means of improving the quality of ready-mixed concrete as delivered to the job. The group is working in conjunction with the Portland Cement Association in matters pertaining to quality control.

A paper dealing with the proportioning, mixing and delivery of transit-mixed concrete was presented by M. D. Catton, of the Portland Cement Association, after which the members discussed the various problems of the industry.

H. F. Thomson, of the General Material Company, of St. Louis, was host to the delegates during a tour of inspection that included a visit to his own transit-mixed concrete plant and a number of construction jobs on which transit-mixed concrete is employed.

At the election of officers, Bruner R. Penniman, of the Penniman Concrete & Material Co., Dallas, Tex., was named president and treasurer. Wm. H. Crangle, of the Metropolitan Concrete Co., Cleveland, Ohio, is central vice-president; Edward Flynn, Morris Plains, N. J., is eastern vice-president; and Douglas Barlow, Tacoma, Wash., is western vice-president.

Goldbeck and Walker Talk Before Ready-Mixed Concrete Operators

An address by A. T. Goldbeck, director, Bureau of Engineering, National Crushed Stone Association, was to be one of the first to be presented before the first annual convention of the National Ready-Mixed Concrete Association, held January 26th at the Hotel Jefferson, St. Louis, Missouri.

Other speakers and the subjects they were to talk on were as follows:

J. L. Shiely, "Suggested Strength Specifications"; Henry D. Johnson, Jr., "Premixed Concrete from the User's Viewpoint"; Stanton Walker, "Yield of Aggregates in the Design of Concrete"; J. C. Eakin, "Operating of Ready-Mixed Concrete in Arkansas"; R. B. Young, "Operations of Ready-Mixed Concrete in Canada"; and address by J. E. Burke, A. C. Butterworth, and Dr. Carl von Giesel.

Personals

R. R. Martel has been appointed professor of structural engineering at the California Institute of Technology, at Pasadena, Calif., formerly known as Throop Institute. Professor Martel was advanced from the grade of associate professor. He has been with the Pasadena institution since 1918, and has been closely associated with the development of a well-equipped structural materials testing laboratory.

L. A. Falco has been elected president and *C. Van de Bogart*, treasurer and chairman of the board of directors of the new firm formed as the result of the merger of the Decorative Stone Company and the Economy Concrete Company on January 1, at New Haven, Conn. Combined resources are $1,000,000, and headquarters are at New Haven and New York.

William R. Johnson, formerly concrete technician for the Aluminum Company of America on the Calderwood dam project in Tennessee, has been appointed research assistant in the engineering testing laboratory at Purdue University, Lafayette, Indiana.

Robert J. Fisher, formerly field engineer for the Wisconsin Concrete Products Association, has joined the Masonite Company as a concrete forms salesman. His headquarters are at Milwaukee.

High Pressure Steam Curing Produces Full Strength in Two Days

Permits Early Handling of Newly Manufactured Concrete Units—48-Hour Strength Fully Up to Strength at One Year—Further Investigation Suggested

COMPLETION of the one-year compression tests on hollow concrete masonry units cured under various conditions, reported by P. M. Woodworth[1] in the October, 1930, *Journal* of the American Concrete Institute, bears out earlier conclusions regarding the value of high-pressure steam curing in developing high early strength.

The 2-day, 9-day and 28-day compression tests were reported by Mr. Woodworth in the February, 1930, *Journal,* and discussions by W. H. Crume and L. J. Pond were printed in the June, 1930, issue of the same publication.

Get Full Strength in Two Days

In his report on the one-year compression tests, Mr. Woodworth presents the accompanying table and diagram. The table contains a summary of the test results and the diagram shows the typical age-strength relation with various curing conditions.

COMPRESSIVE STRENGTH OF VIBRATED CONCRETE MASONRY UNITS

Age Before Curing Hr.	Method of Curing	Condition When Tested	Compressive Strength lb. per sq. in. Gross Area 2-Da.*	9-Da.	28-Da.	1-Yr.
½	12½ hr. in saturated steam at 100 lb. gage pressure then air-cured at 70° F.	Damp	2250	1820	1890	2150
		As Cured	2900	2500	2550	2490
4	"	Damp	2440	2020	2060	2250
		As Cured	2960	2560	2620	2620
8	"	Damp	2530	1970	2150	2420
		As Cured	2760	2580	2990	2300
24	"	Damp	2560	1880	1990	1940
		As Cured	2840	2140	2740	2460
Average	"	Damp	2450	1920	2020	2190
		As Cured	2760	2450	2720	2470
4	12½ hr. in steam at 125° F. and atmospheric pressure then air-cured at 70° F.	Damp	1070	1000	1190	1320
		As Cured	1150	1270	1810	1430
6	12½ hr. under damp straw at plant temperature then air-cured at 70° F.	Damp	770	1110	1310	1420
		As Cured	1060	1360	1930	1570
0	48 hr. under damp straw at plant temperature then moist-cured at 70° F.	Damp	860	1190	1560	2090
		Oven Dry	-------	-------	-------	2950

*2-Day tests made on 200,000-lb. testing machine at Bowser-Morner Testing Laboratories, Dayton, Ohio.

Tests at later ages made on 300,000-lb. testing machine at Portland Cement Association, Chicago.

Compressive tests of 5 by 3¾ by 12-in. concrete tile.

Cement from fresh warehouse stock.

Aggregate: Crume Brick Co. bank sand and crushed gravel graded 0-⅜-in.

Water: 8½ gal. per sack corrected for absorption of aggregate.

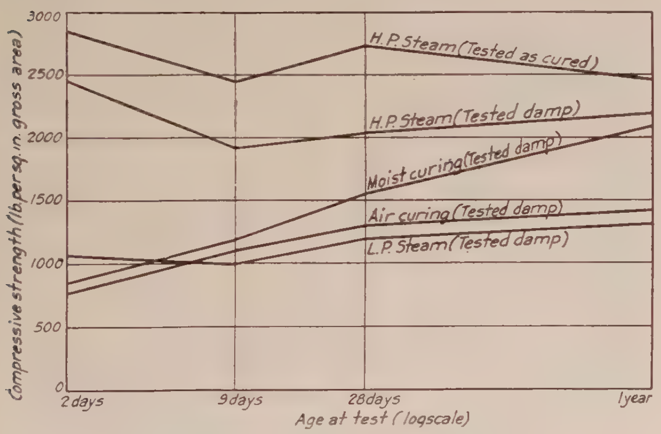
Mix: 1:4:6 damp, loose volume; 1:9.6 dry weight.

Concrete vibrated in molds for 50 seconds at 3600 r.p.m.

Specimens removed from molds 36 to 48 hr. after molding and air-cured until test.

Specimens capped with gypsum 6 hr. before testing.

Unless otherwise noted each value is the average of three tests made on the same day.



Effect of curing on compressive strength of concrete masonry units

The outstanding feature of these tests is that concrete units cured with steam under a 100-lb. pressure for 12 hours and then in air at 50 per cent relative humidity developed strengths in 2 days that averaged 15 per cent higher than the average one-year strength of the moist-cured specimens.

A curious phase of the test results is that the average 2-day strength of the specimens cured under high pressure steam was higher than at the subsequent periods of 9 and 28 days and one year. However, the retrogression in average strength is slight and is not of a nature that suggests continued retrogression.

Early Handling Made Possible

The high early strength obtained with high pressure steam curing means that concrete masonry units so cured can be handled the day after their manufacture. This naturally simplifies manufacturing operations, inasmuch as newly manufactured units may be taken out of the way.

The author's concluding remark points out that high pressure steam curing furnishes a means of developing relatively high concrete strengths at very early ages, and that the promising results obtained by this method of curing show the desirability of further study.

The units used in these tests were manufactured and cured at the plant of the Crume Brick Company, Dayton, Ohio.

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[1] Technical engineer, Cement Products Bureau, Portland Cement Association, Chicago.

1930 Paving Contracts Five Million Sq. Yd. Ahead of 1929

Concrete Highway Contracts Lead Previous Year by 15,000,000 Sq. Yd.—Other Construction Well Maintained

Final figures on concrete road, street and alley paving contracts awarded in 1930 bring the total for the year to 145,819,457 sq. yd., more than five million ahead of 1929, and the highest in concrete paving history. The total is made up of 108,005,864 sq. yd. of concrete road construction and 37,813,593 sq. yd. of street and alley pavements. These figures are slightly better than the figures of 108,000,000 and 36,000,000, respectively, printed on page 13 of the January issue of CONCRETE, in which the December contracts necessarily were estimated. The higher figure on street and alley pavements is due to the significant fact that the December contracts of this class, for the first time in 1930, were higher than for December, 1929.

Concrete paving contracts, as reported by the Portland Cement Association for the month of December and for the full year, are as follows:

SQ. YD. OF CONCRETE PAVEMENTS IN DECEMBER

	1929	1930
Roads	5,306,630	5,081,493
Streets	2,403,649	3,411,241
Alleys	108,959	314,835
Total	7,819,238	8,807,569

SQ. YD. OF CONCRETE PAVEMENTS IN FULL YEAR

	1929	1930
Roads	92,816,794	108,005,864
Streets	43,543,570	35,212,793
Alleys	3,660,387	2,660,800
Total	140,020,751	145,819,457

General building and engineering construction contracts in the 37 states east of the Rocky Mountains were maintained at a figure well up toward the total for December, 1929, and only a trifle lower than for November, according to the following reports compiled by the F. W. Dodge Corporation:

CONSTRUCTION CONTRACTS IN DECEMBER

	1929	1930
Buildings	$264,546,800	$173,524,000
Public works and public utilities	51,821,300	76,411,500
Totals	$316,368,100	$249,935,500

Total contracts for building and engineering construction, for the full year, amounted to $4,525,534,100, compared with a total of $5,771,550,500 in the year 1929.

Building Officials Meet in Toronto in April

The Building Officials' Conference of America, an organization of building commissioners and inspectors, will hold its seventeenth annual meeting in Toronto, Canada, from April 21 to 24, inclusive.

The membership of this organization includes city building inspectors and commissioners throughout the United States and Canada, and officials having similar duties in departments of state and provincial governments and in governmental bureaus.

Col. John W. Oehmann, 1253 Lawrence St., N. E., Washington, D. C., is secretary of the Building Officials' Conference of America. Col. Oehmann is chief inspector of the building inspection division of the District of Columbia.

Winter Planning Will Speed Spring Employment

Announcement of large public construction programs throughout the country reveals that March, April and May may be made months of work, not of idleness, in the opinion of President B. F. Affleck of the Universal Atlas Cement Co. This can be attained, he declared, in hundreds of cases, by arranging during the winter all legal and other construction preliminaries.

"There is challenge as well as encouragement in the recent chamber of commerce survey report of S. W. Straus & Co., that public improvements valued at $4,500,000,000 are now needed," said Mr. Affleck, "and also in the latest *Engineering News-Record* survey indicating that 1931 construction in the same field will approximate $3,250,000,000. The Straus report listed only $1,200,000,000, or less than 30 per cent of the total tabulated as 'now going forward,' and classified the remainder as 'being held up, delayed or postponed.' Some delays and postponements, of course, are inevitable; but do not the unemployment problem, and the partial remedy within our grasp, constitute a challenge that the preventable portion of delays on 1931 projects be speedily eliminated?"

Winter preparation for spring activity and employment, Mr. Affleck suggested, can often serve both economy and humanity by substituting a dollar's worth of job, and perhaps several dollars' worth of self-respect and satisfaction, for each dollar of relief otherwise needed through the spring.

Manufacturers' Problems and Financial Status of Association Discussed at Northwest Meeting

The sixth annual convention of the Northwest Concrete Products Association was held January 9 and 10 at Olympia, Washington.

Different phases of publicity was one of the subjects discussed and was referred to a committee. Another was the cartage of products, brought up by F. L. Martin, which disclosed proper methods of loading to prevent injury.

Bailey Tremper, engineer of tests, Washington State Highway Department, presented a review of concrete culvert pipe investigations, telling of the effect of acid waters on concrete pipe.

Greatest resistance, it was reported, is given by concrete of high quality, of proper proportions. Types and sources of materials and steam curing are not of great importance in determining resistance to acid, he said.

A committee took favorable action on the suggestion that the association declare a moratorium for one year, during which no dues be collected and that dues be reduced after this year, following Treasurer W. P. Hews' report.

Short-Cuts in Structural Design

Charts Provide Quick Method for Finding Required Steel Area and Actual Stress in Concrete in Beams and Slabs—Examples Illustrate Use

I—Unbalanced Reinforcing

By **JAMES R. GRIFFITH**
Professor of Structural Engineering, Oregon State Agricultural College

A CONCRETE beam or slab having balanced reinforcing has its materials so proportioned as to produce maximum allowable stress in both the concrete and steel for the maximum bending moment to be carried.

However, construction or architectural considerations frequently dictate the size of beams or slabs. When this predetermined size, with balanced reinforcing, is such as to have a resisting moment in excess of that to be carried, the amount of steel reinforcing may be reduced. This is said to be unbalanced reinforcing, the unit stress in the steel being the controlling factor. The maximum unit stress in the concrete is, under such conditions, less than the allowable.

Charts for Unbalanced Reinforcing

Two charts have been prepared for solving the problem of unbalanced reinforcing. One is for a unit steel stress of 18,000 lbs. per sq. in., the other for 20,000 lbs. per sq. in. Both charts are based on a breadth of beam or slab of $b = 12$ inches.

This type of chart is sometimes called a "contour chart," the six diagonal lines being contours. In reality, each chart is composed of two three-variable charts having a common variable (f_c). Three contours are labeled AREA OF STEEL, and are to be used with the co-ordinates at the top of the chart giving the area of steel. The other three contours are labeled MOMENT and are to be used with the co-ordinates at the bottom of the chart giving the resisting moment.

Values for Modulus Ratio

Contours are provided for three values of (n). In most specifications (n) varies inversely with the ultimate strength of the concrete. As specified by the A. C. I. Building Code

$$n = \frac{30{,}000}{f'_c}$$

For the three most common classes of concrete used, the values of (n) are

Ultimate Strength of Concrete f'_c Lbs. per Sq. In.	Ratio $n = \frac{E_s}{E_c}$
2,000	15
2,500	12
3,000	10

Examples Illustrating Use of Charts

How the charts are used is best shown by the following typical examples, all based on the chart for $f_s = 18{,}000$ lbs. per sq. in., though the operation is of course similar where the higher steel stress is employed.

PROBLEM 1

Given:

A reinforced concrete slab,

Effective depth to reinforcing, $d = 6$ inches.

Allowable stress:

$f_s = 18{,}000$ lbs. per sq. in.
$f_c = 800$ lbs. per sq. in.

$n = 15$

Bending moment to be resisted, $M = 40{,}000$ in.-lbs. per foot of width.

Required:

Necessary area of steel reinforcing (A_s).

Solution:

If balanced reinforcing is used, the resisting moment of

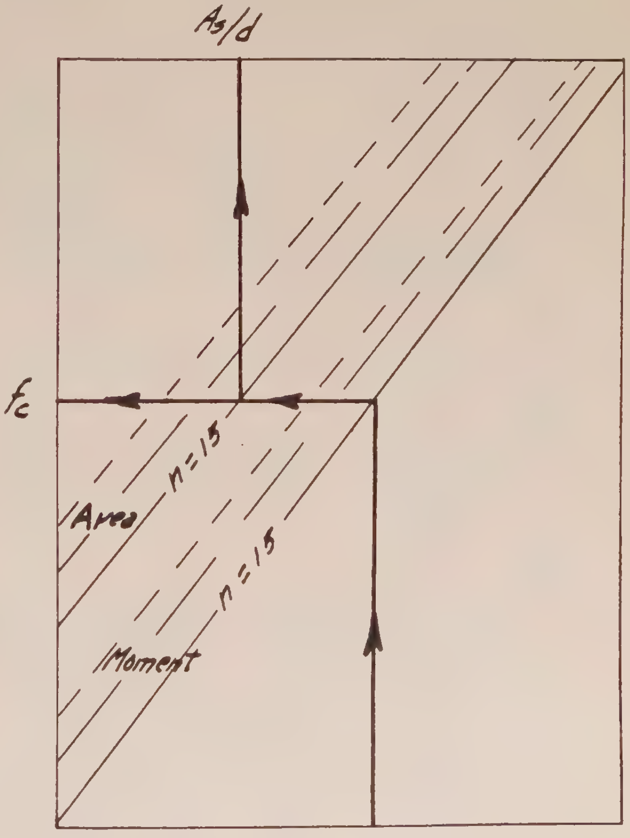


Figure 1

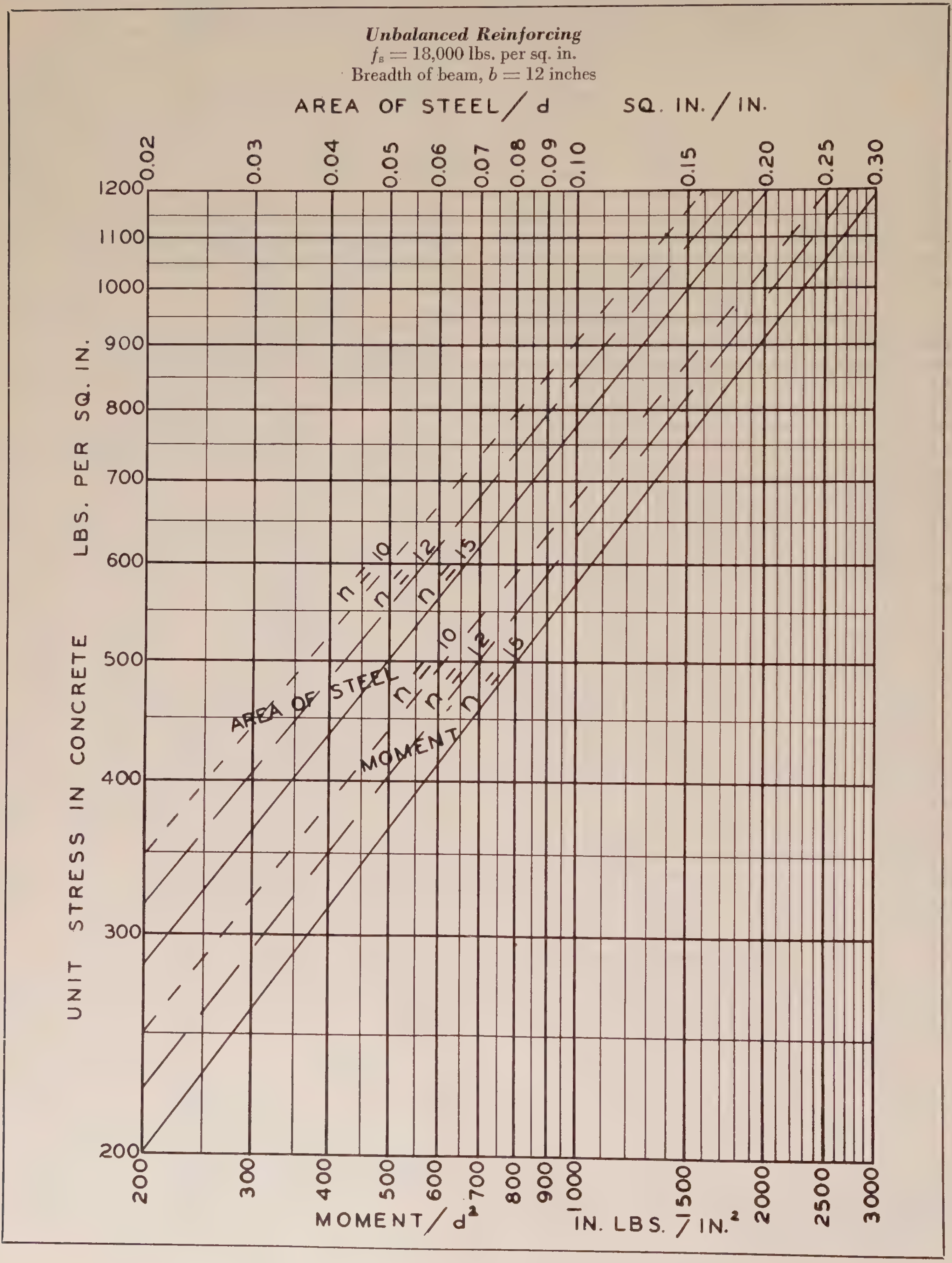
the section per foot of slab width would be

$$M = K\,b\,d^2 = 138.7 \times 12 \times 6^2 = 60{,}000 \text{ in.-lbs.}$$

Since this is in excess of the moment to be carried, unbalanced reinforcing will be used.

$$\frac{M}{d^2} = \frac{40{,}000}{36} = 1{,}110$$

Figure 1 shows the necessary procedure, using the chart

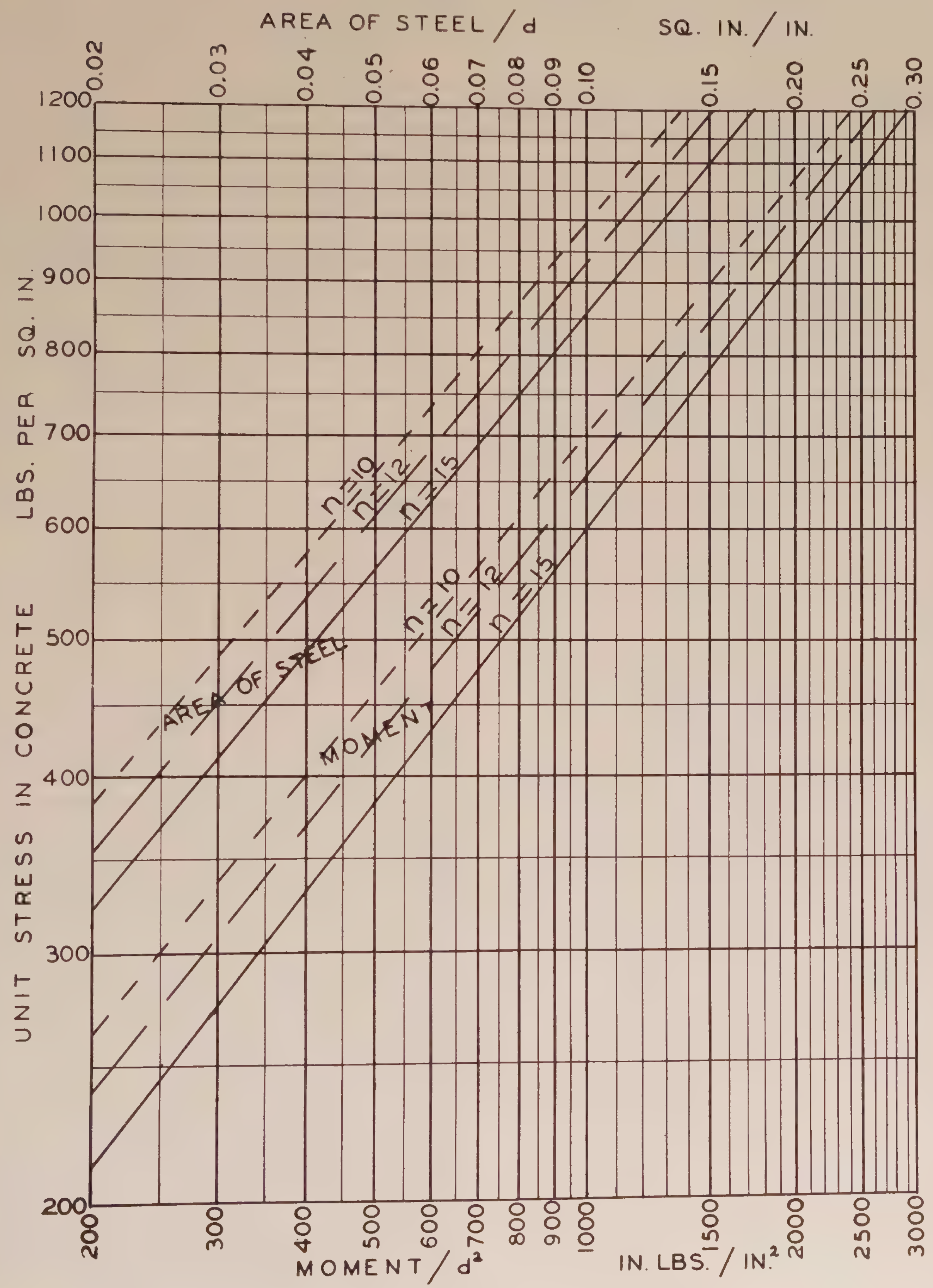


Unbalanced Reinforcing

$f_s = 18{,}000$ lbs. per sq. in.

Breadth of beam, $b = 12$ inches

for $f_s = 18,000$ lbs. per sq. in. Vertically above $M/d^2 = 1,110$, follow up to the moment contour $n = 15$, then horizontally to the left scale, where the maximum stress in the concrete is found to be $f_c = 625$ lbs. per sq. in. Vertically above the intersection of this horizontal line to (f_c) and the area of steel contour $n = 15$, is found the value



Unbalanced Reinforcing

$f_s = 20,000$ lbs. per sq. in.

Breadth of beam, $b = 12$ inches

$$\frac{A_s}{d} = 0.072$$

The necessary area of steel is then

$$A_s = d(0.072) = 6 \times 0.072 = 0.432 \text{ sq. in.}$$

Had balanced reinforcing been used the area of steel would have been

$$A_s = p\,b\,d = 0.0089 \times 12 \times 6 = 0.642 \text{ sq. in.}$$

PROBLEM 2

Given:

A reinforced concrete beam,
$b = 12$ inches,
$d = 18$ inches,
Reinforcing, four ⅝-inch round bars.
$A_s = 1.23$ sq. in.
Maximum allowable stress:
$f_s = 18{,}000$ lbs. per sq. in.
$f_c = 800$ lbs. per sq. in.
$n = 15$

Required:

Maximum resisting moment.

Solution:

$$\frac{A_s}{d} = \frac{1.23}{18} = 0.0684$$

The necessary steps are shown on Figure 2. Using the chart for $f_s = 18{,}000$ lbs. per sq. in., the value of A_s/d is found at the top of the chart. Vertically below this value of A_s/d to the AREA OF STEEL contour $n = 15$, then horizontally to the left is found

$$f_c = 620 \text{ lbs. per sq. in.}$$

At the intersection of this horizontal line with the moment contour $n = 15$, vertically below will be found the value

$$\frac{M}{d^2} = 1090$$

The resisting moment will then be

$$M = d^2(1090) = 18^2 \times 1090 = 353{,}000 \text{ in.-lbs.}$$

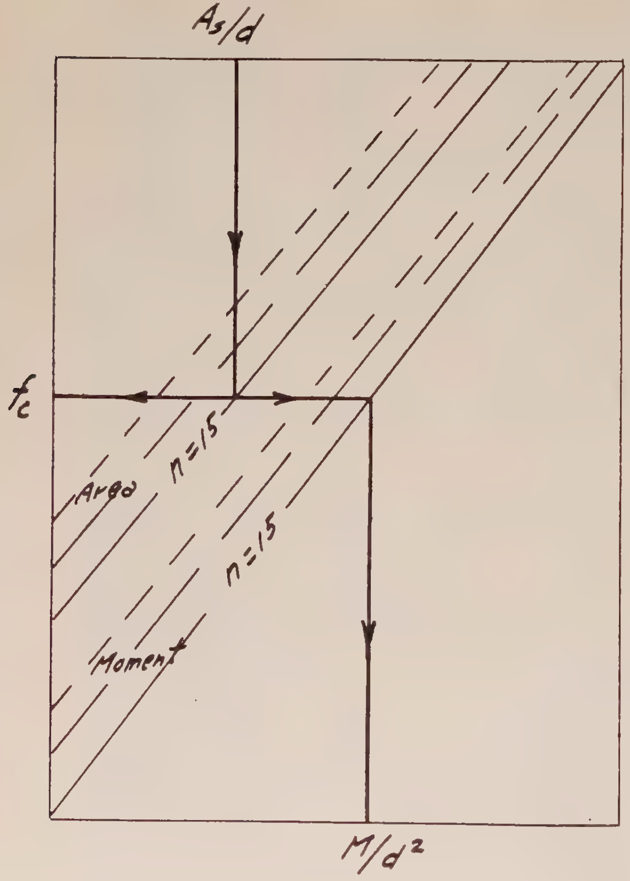


Figure 2

PROBLEM 3

Given:

Beam dimensions:
$b = 14$ inches
$d = 24$ inches
$f_s = 18{,}000$ lbs. per sq. in.
$f'_c = 2{,}000$ lbs. per sq. in.
$n = 15$
Bending moment, $M = 500{,}000$ in.-lbs.

Required:

Necessary area of steel reinforcing (A_s).

Solution:

Since the charts are based on a value of $b = 12$ inches, it is necessary to proportion the moment on that basis.

For the given beam, $b = 24$ inches
$M = 500{,}000$ in.-lbs.

For a value of $b = 12$ inches

$$M = \frac{12}{14}(500{,}000) = 428{,}000 \text{ in.-lbs.}$$

$$\frac{M}{d^2} = \frac{428{,}000}{24 \times 24} = 745$$

From the chart for $f_s = 18{,}000$ lbs. per sq. in., using the same procedure as in Figure 1

$$f_c = 475 \text{ lbs. per sq. in.}$$

$$\frac{A_s}{d} = 0.045, \text{ for a 12-inch } (b) \text{ beam.}$$

For a value of $b = 14$ inches, as given

$$A_s = \frac{14}{12}(0.045 \times 24) = 1.26 \text{ sq. in.}$$

I am making no claim for the originality of this method of solution. One of the men with whom I worked last summer had a table prepared giving this same information for one value of (n). Like many such short-cuts, which are frequently handed down and copied by many individuals, its origin was uncertain. But the table required interpolation for intermediate values, and interpolation is irksome. The charts herein presented are the result of plotting the same values to logarithmic co-ordinates, with the material for other values of (n) added.

* * *

EDITOR'S NOTE: A few building codes still limit the stress in steel reinforcing to 16,000 lbs. per sq. in. Readers desiring a similar chart for that stress can obtain blue-line prints for one dollar each by writing direct to Professor Griffith at Corvallis, Oregon.

A. S. C. E. Papers Available in Pamphlet Form

The American Society of Civil Engineers, 33 West Thirty-ninth Street, New York, has printed a 48-page list of papers and discussions printed by the society which are available in separate pamphlet form. The list includes 1,447 out of a total of 1,721 papers published by this organization since 1868.

HOW TO DO IT

Questions and Answers
Consultation and Comment

A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Preventing Floor Dusting

How can floor surfaces be hardened to prevent dusting?—P. G. D., Cincinnati, O.

Much of the trouble encountered with new floors dusting is caused by delivery of the floor in a dirty condition. Traffic then grinds this dirt into the floor, where its presence causes the dust frequently attributed to the floor finish. To remove dirt, the surface should be well swept with a stiff broom, and thoroughly scrubbed with soapsuds. The suds then should be mopped up and the surface flushed with clean warm water and again mopped.

Under certain conditions it may be advisable to use a hardener treatment on the surface of the floor, although such treatments are not cure-alls for poor workmanship or careless practice. Such compounds as magnesium fluosilicate, sodium silicate, aluminum sulphate, zinc sulphate and various oils, gums, resins and paraffins are used in arresting dusting of defective floor finish.

Effect of Maximum Size of Coarse Aggregate

We have an opportunity to utilize a high grade of gravel in which the maximum sizes are considerably larger than usually specified for coarse aggregates, but there is considerable difference of opinion concerning the wisdom of doing so. A study of such technical literature as I can find has served only to confuse me more.

Can you state the probable effect of variations in the maximum size of coarse aggregate on the compressive strength and workability of concrete, assuming the coarse aggregates of each size to be similarly well graded?—J. R. H., Little Rock, Ark.

Your inquiry was referred to Stanton Walker, director of the engineering and research division of the National Sand and Gravel Association, who is a recognized authority on this subject. The following answer to your question is taken from his reply:

No quantitative answer, Mr. Walker asserts, can be given to this question, since the results are affected an important amount by the proportions, consistency and method of placing the concrete. In general, if the cement content and consistency are maintained constant, the compressive strength of concrete increases as the maximum size of the aggregate increases. The amount of increase depends on the effect which the change in size and grading has on the quantity of mixing water required to maintain the same consistency, when the mixing water is expressed as a ratio to the cement. For a constant cement content per unit of volume of concrete and a constant consistency, the change in mixing water requirements depends, to the greatest extent, on the proportion of sand to coarse aggregate used in each case. If the ratio of cement, sand and coarse aggregate is maintained the same for the different sizes, the water requirements are affected a comparatively small amount by changes in grading of the coarse aggregate and there is a correspondingly small effect on the strength. On the other hand, if more sand is used with the small-sized aggregate than with the large-sized one, there is a correspondingly greater effect on the water requirements and consequently a greater spread in strength.

While, as pointed out above, a quantitative statement of the effect of maximum size of aggregate on strength cannot be given, the following should serve to give an idea of the magnitude of the changes which may be expected when the same consistency, cement content and proportions of sand to coarse aggregate are used for each size.

Maximum size of similarly graded coarse aggregates (Square sieves)	Approximate percentage of compressive strength of concrete made with coarse aggregate having a maximum size of 1½ in.	
	Lean mixes	Rich mixes
⅜-in.	75-80	85-90
¾-in.	85-90	90-95
1 -in.	90-95	95-100
1½-in.	100	100
2 -in.	100-105	100-103
3 -in.	105-110	103-106

If different proportions of sand and coarse aggregate are used for the different maximum sizes, results differing from those in the above table will be found. Since the grading of the material plays such an important part in fixing the quantity of mixing water required, it is not practicable to state any average percentages which may be considered as generally representative.

Of course if the water-ratio (mixing water expressed in terms of cement) and consistency of the concrete are maintained constant, changes in size of aggregate will not affect the strength of the concrete so long as the mix is workable. There will, however, be a change in the cement requirements,—slightly more cement being required for the smaller sizes. The magnitude of the change in cement content will depend on the same factors discussed above; the change will be small when the proportion of sand to coarse aggregate is kept the same.

The term workability, as referring to concrete, is a somewhat intangible property that has not been satisfactorily defined or measured. However, ease of placing and ability to resist segregation during handling must, undoubtedly, be considered as important factors in measuring workability. In this respect, the workability may be said to decrease as the size of the aggregate increases. Workability, however, will be governed more particularly by the proportion of cement, sand and coarse aggregate, than by the maximum size of the coarse aggregate.

The Concrete Industry
–25 YEARS AGO

SANFORD E. THOMPSON, in an article entitled, "Concrete Aggregates," presented before the current meeting of the National Cement Users' Association, points out the principles to be followed in selecting aggregates, testing, and determining proportions which he had found to give good results in practice.

* * *

ANOTHER article in the February, 1906, issue of CONCRETE tells of a series of investigations carried on at the Laboratories for the Testing of Structural Materials, under the direction of the United States Geological Survey at St. Louis, in charge of Richard L. Humphrey.

A $50,000 appropriation made in the previous year was reported exhausted and a further amount reported being sought through the action of Congress.

* * *

C. A. P. TURNER, in a paper presented to the National Association of Cement Users on "Cement and Building Construction," tells of his experiences in the use of reinforced concrete and concrete brick.

* * *

CONSTRUCTION of a reinforced concrete factory building at Despatch, New York, is described, with some detail on reinforcement steel, design and form work.

* * *

AN outstanding use of concrete and hollow tile in a building 25 years ago was the Blenheim hotel, under construction at Atlantic City, New Jersey, according to the February issue of *Cement Age*.

"In the floors the construction of concrete and hollow tile was effected by the use of reinforced concrete girders carrying many shallow transverse reinforced concrete floor beams in connection with a 2-inch concrete slab. Hollow tiles occupy the spaces between and were rapidly put in place."

* * *

DAVID LAY, in the space of 8 pages, tells about the increasing use of concrete piles and the method of manufacturing the two principal types.

* * *

"THE Use of Portland and Natural Cements," by E. S. Larned, tells how the adoption of standard specifications benefited the industry and happily displaced the individual cement tester.

* * *

THE second annual meeting of the National Association of Cement Users was held at Milwaukee, Wisconsin, from January 9 to 12, and is reported on in the then current issue of *Cement Age*.

" . . . the convention was distinguished by the presence of a large body of enthusiastic, hard-working, intelligent members of what might be practically called a new art, and was distinguished further for the great growth the Society made in membership . . . "

The various papers presented are reported on, some of them being as follows: "Air Tamping and Conveying Concrete Blocks," by J. P. Sherer, "Slag Sands in Concrete," by R. A. Cummings, and "Concrete Aggregates" by Sanford E. Thompson.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit, Michigan.

Annual convention, Feb. 24-26, Hotel Schroeder, Milwaukee, Wis.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 W. Grand Ave., Chicago.

Twenty-fourth annual convention, February 23-24. Edgewater Beach Hotel, Chicago, Illinois.

American Standards Association; P. G. Agnew, Secretary, 29 West 39th St,, New York City.

American Road Builders' Association; Chas. Upham, Engineer-Director, 914 National Press Building, Washington, D. C.

American Society of Civil Engineers; Geo. T. Seabury, Secretary, 33 W. Thirty-ninth St., New York City.

American Society for Testing Materials; C. L. Warwick, Secretary-Treasurer, 1315 Spruce St., Philadelphia, Pa.

Annual meeting, June 22-26, Stevens Hotel, Chicago.

Associated General Contractors of America; E. J. Harding, Assistant General Manager, 1150 Munsey Bldg., Washington, D. C.

Cast Stone Institute; L. A. Falco, Secretary, Chapel St. and Blatchley Ave., New Haven, Conn.

Building Officials Conference of America; Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.

Seventeenth annual meeting, April 21-24, Toronto, Ont., Canada.

Cement Institute; Luther G. McConnell, General Manager, 11 East 44th St., New York City.

Concrete Masonry Association; Jack Franklin, Secretary, 7071 Plankinton Bldg., Milwaukee, Wis.

Annual convention, Feb. 23-26, Hotel Schroeder, Milwaukee, Wis.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, Tribune Tower, Chicago.

Seventh annual meeting, March 16-18. Edgewater Gulf Hotel, Biloxi, Mississippi.

Engineering Institute of Canada; 2050 Mansfield St., Montreal, Quebec.

Forty-fifth annual meeting, February 4-6, Windsor Hotel, Montreal, Quebec.

Joint Committee on Standard Specifications for Concrete and Reinforced Concrete; F. R. McMillan, Secretary, 33 W. Grand Ave., Chicago.

National Board of Fire Underwriters; W. E. Mallalieu, General Manager, 85 John St., New York City.

National Concrete Burial Vault Association; J. H. Stuart, Secretary-Treasurer, Bremen, Ohio.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Bldg., Washington, D. C.

National Fire Protection Association; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

Annual meeting, May 12-16, Toronto, Ontario, Canada.

National Lime Association; Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N. W., Washington, D. C.

National Ready-Mixed Concrete Association; Headquarters, 27 Barbeau St., Pittsburgh, Pa.

National Sand and Gravel Association; V. P. Ahearn, Executive Secretary, 432 Munsey Bldg., Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, 937 Leader Bldg., Cleveland, Ohio.

National Terrazzo and Mosaic Association; U. F. Durner, Secretary, 809 St. Paul Ave., Milwaukee, Wis.

Annual convention, April 27-30. Biltmore Hotel, Atlanta, Georgia.

Northwest Concrete Products Association; W. P. Hews, Secretary-Treasurer, Yakima, Wash.

Portland Cement Association; William M. Kinney, General Manager, 33 W. Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary, Builders' Building, 228 N. La Salle St., Chicago, Ill.

Wisconsin Concrete Products Association; Jack Franklin, Secretary-Treasurer, 425 East Water St., Milwaukee, Wis.

Annual convention, February 23-26, Hotel Schroeder, Milwaukee.

New Equipment and Materials

New Multiplex Tamping Unit Comes Out in February

The Multiplex Concrete Machinery Company, Elmore, Ohio, will make complete announcement during February of a new, simple, low-priced tamper.

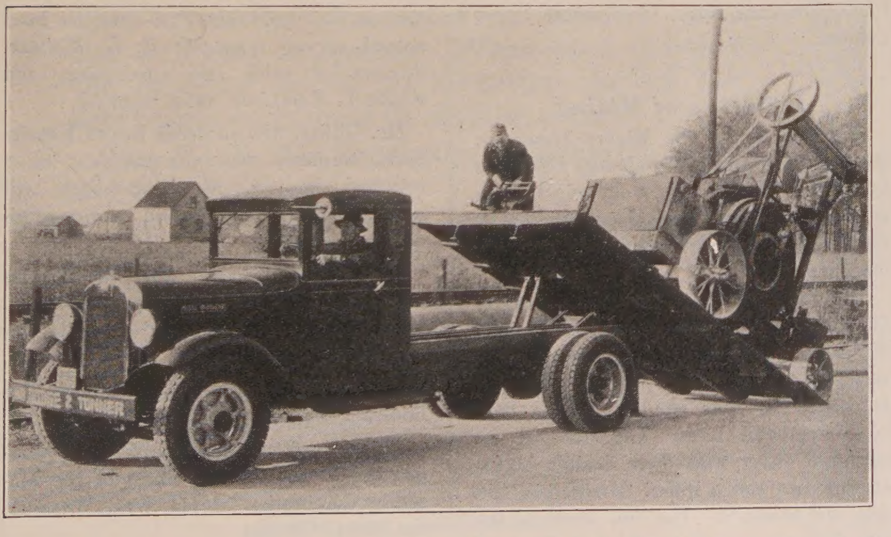
In the meantime, the following description is offered: The machine is a combination stripper and face-down machine, producing also the press top finish such as is made on the regular press machine. One base is used for both types of block.

The unit is without sprockets, gears or chain.

New Powermatic Unit Speeds Truck Deliveries

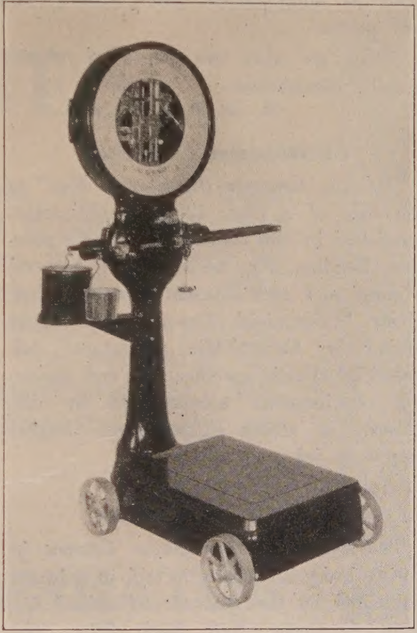
The Powermatic unit is said to increase truck efficiency by reducing loading and unloading time. The unit operates directly from a conventional transmission power take-off without any necessity of the driver leaving his seat. It is capable of loading 5 tons and will unload 7 tons with ease. It is adaptable to all makes of trucks. Quick acting jacks at the rear of the truck frame relieve the truck axle of all unloading strains.

To operate, a lever in the truck cab is moved to engage the power unit. The body moves backward, the rear edge of the body being lowered slowly to the ground while the front is elevated. As the load touches the ground, the truck is slowly driven a short distance forward. It is a product of the Griswold Powermatic Corporation of Detroit.



Many Uses for Toledo Aggregate Auto Gage

Manufacture of an Aggregate Auto Gage has recently been announced by Toledo Precision Devices, Inc., a subsidiary of the Toledo Scale Company, Toledo, Ohio.



The moisture content of the regular run of each aggregate having been determined, this device will automatically weigh out the specified amounts of the various aggregates, compensating for the surface moisture in each. Cement and water can then be added by weight in right proportion, if desired.

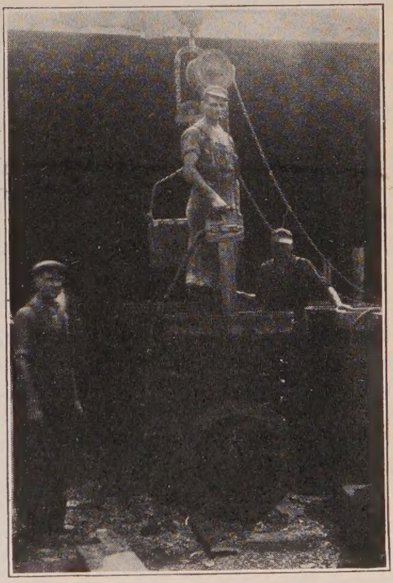
The Toledo Aggregate Auto Gage will determine the specific gravity of concrete aggregates, determine the per cent of moisture of concrete aggregates, compensate for surface moisture of concrete aggregates, show exact weight of dry aggregates, indicate the weight of regular run aggregates, show actual weight of surface moisture, and make sieve analysis.

This device is designed primarily for production, laboratory and inspection work. It insures correct water-cement ratio, correct proportion of cement to volume of concrete, uniformity of product, strength and durability.

Branford Vibrator Equipment for Plant and Job Available

Various types of equipment for the vibration of precast and monolithic concrete are manufactured by the Malleable Iron Fittings Company, Branford, Connecticut.

Tests made at a laboratory at Yale University on blocks of "vibrated" concrete 6 in. square and 24 in. long disclosed a strength of 7,000 lb. per sq. in. at the age of nine days, the manufacturer of the equipment claims.



For the products plant there is the vibrator table, and mold vibrators. The table is held by a spring support at each corner and handles molds containing up to 2,000 lbs. of concrete. The mold unit is made in six sizes.

Vibrator slicing spades are also available.

About Makers of Equipment and Materials

Industrial Literature

New Ryerson Tool, Equipment Catalog

A catalog published recently by *Joseph T. Ryerson & Son, Inc.*, Chicago, includes practically every type of tool and portable machinery used in the metal working field. Unlike most catalogs of this nature, all supplies are omitted, the book being devoted entirely to equipment for contractors, manufacturers and job shops.

The following is some of the equipment described and illustrated:

Electric tools including drills and grinders; pneumatic tools of all types; hoisting equipment including hand operated, air and electric hoists; trolleys, small cranes, trucks and jacks, and small tools.

This material has been condensed into a single volume of 158 pages.

Double Screed and Tamper on Finisher

The combining of two screeds and a tamper in one finishing machine is heralded as a new *Ord* development in printed matter distributed by the *Blaw-Knox Company*, Pittsburgh, Pa., recently. There is a front screed, tamper, which is optional, rear screed, and belter.

When dry, stiff concrete is used and tamping is permitted or specified, the Ord can be furnished with a tamper without sacrificing the accepted double screed principle, it is stated.

Batch and Truck Mixers

Literature distributed at the recent St. Louis exposition by the *Portland Concrete Machines Company*, Cleveland, Ohio, comprised a loose-leaf publication on its open drum batch mixer and a 4-page leaflet on its truck mixers.

The batch mixer is described in detail, reference being made to its construction, details of operating features, end liners, bearings, etc.

Why to Inspect

A booklet addressed to architects, engineers, owners, and contractors and entitled *"The Protective Value of Independent Inspections"* is now being distributed by the *Pittsburgh Testing Laboratory*, Pittsburgh, Pa.

Its purpose is to discuss the subject frankly and thoroughly, dealing with the advisability of inspection of operations and materials incident to construction.

Mixers on Autocars

"Concrete Mixers Mounted on Autocar Chasses" is a booklet just completed by the *Autocar Company*, Ardmore, Pa. Technical information referring to Autocar chassis has been assembled to make this a complete publication. Each page contains two diagrammatic views, followed by unit prices.

There are also two pages of photographic illustrations.

Clintonized Concrete

"Hauling Concrete the Clinton Way" is the title of a new, 12-page publication, published by the *Clinton Motors Corporation*, Reading, Pa., telling about "Central Mixing and the Clinton Process," then about "Clintonized Concrete — A Profit Maker for Central-Mix Operators," followed by chassis specifications and mounting requirements accompanied by diagrams. A dozen illustrations, largely scenes on jobs, are given.

Super Cement Uses

The use of *Dragon Super Cement* in curing leaky basements is told in a leaflet published by the *Lawrence Portland Cement Company*, New York City. The method recommended is the plastering of two coats of Super Cement mortar on the inside of the wall.

Four other circulars cover as many separate, structural uses of Dragon Super Cement.

Influence of Mixing

The Influence of the Mixing System on the Lasting Properties of Quality Concretes is the title of a 16-page 6 by 9-inch illustrated pamphlet published in English by *H. E. DeWeerdt*, 125 Kuth St., Cologne, Germany.

The pamphlet describes and illustrates the Eirich mixer, which consists essentially of a mixing pan rotated in a direction opposite to that of a mixing star. The pan is carried by four trunnion rollers with machine-ground faces. The star can be equipped either with three flexible blades or with two and a roller. Mixing-pan and star are eccentric. The full layer in the pan does not exceed one-third of the total capacity. Batches from half to full layer mixed with same precision. Outlet through central tight-shutting valve. No dropping of the aggregate during the mixing process. The speed of the pan is 12 and of the star 60 r.p.m. Manganese cast steel blades bolted to the flexible arms. Other features are the adjustable height of blades, adjustable height of roller which follows the layer in the pan, adjustable flexibility of blades, all gears dust-proof enclosed, open pan for lifting samples and any watering device, and ball bearings for all main shafts.

Barber-Greene Unit

The new Barber-Greene *Model* 62 *Super-Bucket Loader* is described in an 8-page leaflet of the same number published by *Barber-Greene Company*, Aurora, Ill. Such features as the patented power boom hoist, longer and higher boom, and automatic crowding feed, are listed and specifications are given in detail.

Flex-Plane Joints

Catalog L-5, published by the *Flexible Road Joint Machine Company*, Warren, Ohio, and distributed at the recent St. Louis road exposition, is a study of concrete road joints and presents the features of Flex-Plane. Profuse illustrations show installations of different types.

Notes From the Field

Masonite Executives

Several new appointments of executives are announced by the *Masonite Corporation*, at Chicago. *John P. Gillies* has been named general manager; *R. G. Wallace*, director of sales and advertising, and *Frank L. Campbell*, sales manager.

Mr. Gillies, who succeeds Brown Katzenbach, formerly was vice-president of a utilities company. Mr. Katzenbach will remain with the corporation as vice-president and director.

Mr. Wallace formerly was general sales manager of the Masonite Corporation, which position he has held since its inception five years ago.

Mr. Campbell recently was manager of a linoleum company at Chicago.

These executives will have their headquarters in the general offices of the Masonite Corporation at 111 West Washington street, Chicago.

Autocar Building Contract

Autocar Company, of Ardmore, Pa., has just awarded contract for erection of a new building for its branch at Providence, R. I., to provide larger facilities for servicing its trucks in that state.

MILL SECTION of
Concrete

QUICK DETERMINATION OF FINES....

THE increasing fineness to which high grade portland cement is now pulverized has created the need of an improvement in the methods for making tests for fineness. The finer the cement or other material is pulverized, the greater becomes the necessity for quick, accurate fineness determinations. Mechanical sieving is not satisfactory for the extreme fines.

THE FLS SEPARATOR

is made to meet the demands for the quick, accurate determination of the amount of "fine flour" in cement or other pulverized material. This separator, illustrated, is compact, precise, and easy to operate. When once charged, the machine needs no attention during the short time consumed in making a test.

The F.L.S. Air Separator is delivered tested and standardized.

The intimate relation existing between the strength of the cement and the size of the individual particles in the cement increases the importance of the test by air separator. The F.L.S. Separator is a necessary requisite for all laboratories when great fineness determinations are made.

◆

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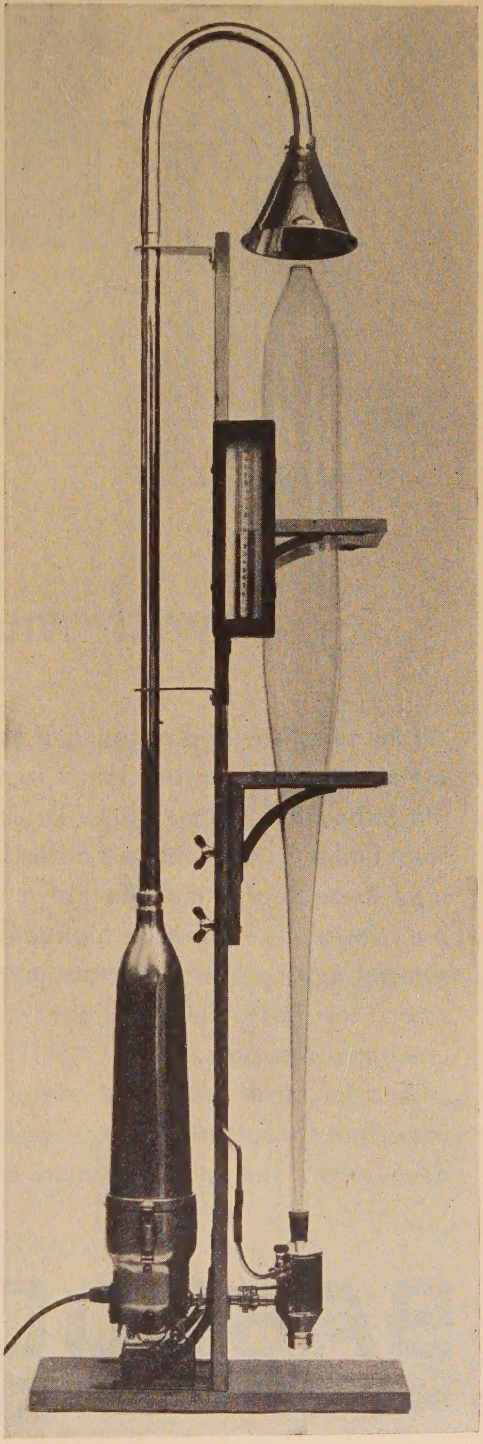
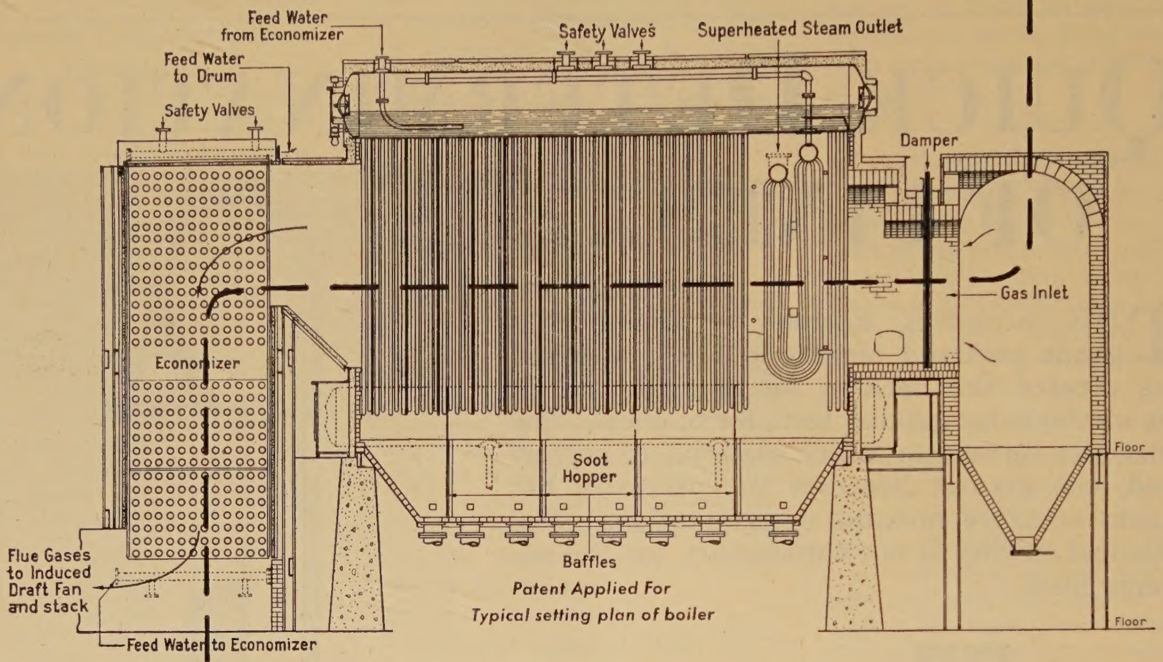


Single Pass Simplicity



Patent Applied For

Typical setting plan of boiler

with multiple pass effect

All the simplicity and absence of baffles of the single pass construction is realized in the Babcock & Wilcox Three Drum Waste Heat Boiler . . . and with this distinct advantage there is also the effect of a multiple pass design. The result is a high rate of heat transfer and a low draft loss in a boiler where the gases flow straight through in one horizontal pass.

And low draft loss is but one of several important characteristics possessed by this new boiler. The most common cause of brickwork trouble is eliminated and air infiltration is reduced to a minimum. This boiler has a high rate of heat transfer with the simplicity of single pass construction and the effect of a multiple pass design. In many other ways this boiler reflects the experience that The Babcock & Wilcox Company has had in the utilization of waste heat boilers . . . experience that dates back as far as 1874. Details of this new boiler will be gladly furnished upon request . . . simply ask for Bulletin G-10.

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